



PA-T3+ Serial Port Adapter Installation and Configuration

Product Numbers: PA-T3+(=), PA-2T3+(=)

Platforms Supported: Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches, Cisco 7200 Series, Cisco 7301 Router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 Router, Cisco 7401ASR Router, VIP in the Cisco 7000 Series and Cisco 7500 Series

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Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services. This preface contains the following sections:

- Objectives, page vii
- Organization, page viii
- Related Documentation, page viii
- Obtaining Documentation, page x
- Obtaining Technical Assistance, page xi
- Obtaining Additional Publications and Information, page xiii

Objectives

This document describes how to install and configure the one-port (PA-T3[=]) and the two-port (PA-2T3[=]) T3+ serial port adapters, hereafter referred to as the PA-T3+, which are used in the following platforms:

- Catalyst 6000 family FlexWAN module in the Catalyst 6000 family switches
- Cisco 7200 series routers—consisting of the two-slot Cisco 7202, four-slot Cisco 7204 and Cisco 7204VXR, and six-slot Cisco 7206 and the Cisco 7206VXR
- Cisco 7301 router
- Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router
- Cisco 7401ASR router
- VIP in Cisco 7500 series and Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI)

Organization

This document contains the following chapters:

Section	Title	Description
Chapter 1	Overview	Describes the PA-T3+ and its LED displays, cables, and receptacles.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
Chapter 3	Removing and Installing Port Adapters	Describes the procedures for installing and removing PA-T3+ port adapters in the supported platforms.
Chapter 4	Configuring the PA-T3+	Provides instructions for configuring the PA-T3+ on the supported platforms.

Related Documentation

Your router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- Cisco IOS software:

For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.



Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>.

- Catalyst 6000 family FlexWAN module:

For hardware installation and maintenance information, refer to the following publications:

- *Catalyst 6000 Family FlexWAN Module Installation and Configuration Note*
- The hardware and software publications that shipped with your Catalyst 6000 family switch

- Cisco 7000 series routers:

For hardware installation and maintenance information, refer to the following publications:

- *Cisco 7000 Hardware Installation and Maintenance* that shipped with your router.
- *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
- *Fourth-Generation Versatile Interface Processor (VIP4) Installation and Configuration*
- *Versatile Interface Processor (VIP6-80) Installation and Configuration*

- Cisco 7200 series routers:
 - For port adapter hardware and memory configuration guidelines, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
 - For hardware installation and maintenance information (including the Cisco 7206 or Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), refer to the installation and configuration guide that shipped with your Cisco 7200 series router.
- Cisco 7200 VXR routers:

For hardware installation and maintenance information, refer to the *Cisco 7200 VXR Installation and Configuration Guide* that shipped with your Cisco 7200 VXR router.
- Cisco 7301 routers:

For hardware installation and maintenance information, refer to the *Cisco 7301 Installation and Configuration Guide* or the *Cisco 7301 Router Quick Start Guide*.
- Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers:

For hardware installation and maintenance information, refer to the *Cisco 7304 PCI Port Adapter Carrier Card Installation and Configuration Guide*.
- Cisco 7401ASR routers:

For hardware installation and maintenance information, refer to the *Cisco 7401ASR Installation and Configuration Guide* or the *Cisco 7401 ASR Quick Start Guide*.
- Cisco 7500 series routers:

For hardware installation and maintenance information, refer to the following publications:

 - *Cisco 7500 Installation and Configuration* or the quick start guide that shipped with your router
 - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
 - *Fourth-Generation Versatile Interface Processor (VIP4) Installation and Configuration*
 - *Versatile Interface Processor (VIP6-80) Installation and Configuration*
- For international agency compliance, safety, and statutory information for WAN interfaces:
 - *Site Preparation and Safety Guide*
 - Regulatory Compliance and Safety Information for the Catalyst 6000 Family Switches
 - *Regulatory Compliance and Safety Information for the Cisco 7000 Series Routers*
 - *Regulatory Compliance and Safety Information for the Cisco 7200 Series Routers*
 - *Cisco 7301 Series Internet Routers Regulatory Compliance and Safety Information*
 - *Cisco 7401ASR Regulatory Compliance and Safety Information*
 - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*
- To view Cisco documentation or obtain general information about the documentation, refer to the following sources:
 - [“Obtaining Documentation” section on page x.](#)
 - [“Obtaining Technical Assistance” section on page xi.](#)
 - [“Obtaining Additional Publications and Information” section on page xiii](#)
 - Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding Cisco-observed holidays).
 - *Cisco Information Packet* that shipped with your router.

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

<http://www.cisco.com/univercd/home/home.htm>

You can access the Cisco website at this URL:

<http://www.cisco.com>

International Cisco websites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated regularly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual or quarterly subscription.

Registered Cisco.com users can order a single Documentation CD-ROM (product number DOC-CONDOCCD=) through the Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/ordering_place_order_ordering_tool_launch.html

All users can order monthly or quarterly subscriptions through the online Subscription Store:

<http://www.cisco.com/go/subscription>

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You can find instructions for ordering documentation at this URL:

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You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products MarketPlace:
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- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

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- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

<http://tools.cisco.com/RPF/register/register.do>

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two types of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The type of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration. There is little or no impact to your business operations.
- Priority level 3 (P3)—Operational performance of the network is impaired, but most business operations remain functional. You and Cisco are willing to commit resources during normal business hours to restore service to satisfactory levels.

- Priority level 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively impacted by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.
- Priority level 1 (P1)—An existing network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Cisco TAC Website

The Cisco TAC website provides online documents and tools to help troubleshoot and resolve technical issues with Cisco products and technologies. To access the Cisco TAC website, go to this URL:

<http://www.cisco.com/tac>

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<http://www.cisco.com/tac/caseopen>

If you have Internet access, we recommend that you open P3 and P4 cases online so that you can fully describe the situation and attach any necessary files.

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<http://tools.cisco.com/RPF/register/register.do>

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<http://www.cisco.com/tac/caseopen>

If you have Internet access, we recommend that you open P3 and P4 cases online so that you can fully describe the situation and attach any necessary files.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The *Cisco Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

http://www.cisco.com/en/US/products/products_catalog_links_launch.html

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary*, *Internetworking Technology Handbook*, *Internetworking Troubleshooting Guide*, and the *Internetworking Design Guide*. For current Cisco Press titles and other information, go to Cisco Press online at this URL:

<http://www.ciscopress.com>

- *Packet* magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access *Packet* magazine at this URL:

<http://www.cisco.com/go/packet>

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

- Internet Protocol Journal is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html



Overview

This chapter describes the PA-T3+ and contains the following sections:

- [Port Adapter Overview, page 1-1](#)
- [Features, page 1-2](#)
- [Interoperability Guidelines for PA-T3+ DSUs, page 1-3](#)
- [LEDs, page 1-3](#)
- [Cables and Connectors, page 1-4](#)
- [Management Information Base, page 1-5](#)
- [Port Adapter Slot Locations on the Supported Platforms, page 1-5](#)
- [Identifying Interface Addresses, page 1-10](#)

Port Adapter Overview

The PA-T3+ port adapter provide a full-duplex operation at T3 (45 Mbps) speed. They support both 16- and 32-bit cyclic redundancy checks (CRCs); the default is 16-bit CRCs. You can change the default setting with software commands.

The one-port PA-T3+(=), shown in [Figure 1-1](#), provides up to two network interfaces per Catalyst 6000 family FlexWAN module in the Catalyst 6000 family switches. The two-port PA-2T3+(=), shown in [Figure 1-2](#), provides up to four network interfaces per Catalyst 6000 family FlexWAN module in the Catalyst 6000 family switches.

The Cisco 7000 series router and the Cisco 7500 series router accept the VIP. You can install either one or two PA-T3+ or PA-2T3+ port adapters per VIP. The PA-T3+(=) is a one-interface version, shown in [Figure 1-1](#), and the PA-2T3+(=) is a two-interface version, shown in [Figure 1-2](#).

The Cisco 7304 PCI Port Adapter Carrier Card, which installs into the Cisco 7304 router module slots 2 through 5, accepts one PA-T3+ or PA-2T3+ port adapter. This provides one or two network interfaces, respectively, per Cisco 7304 PCI Port Adapter Carrier Card.

See the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines* for information on the number of PA-T3+ port adapters you can install in a Cisco 7200 series router.

The PA-T3+ port adapters can be installed in the single port adapter port of the Cisco 7301 router or the Cisco 7401ASR router.

Figure 1-1 One-Port PA-T3+

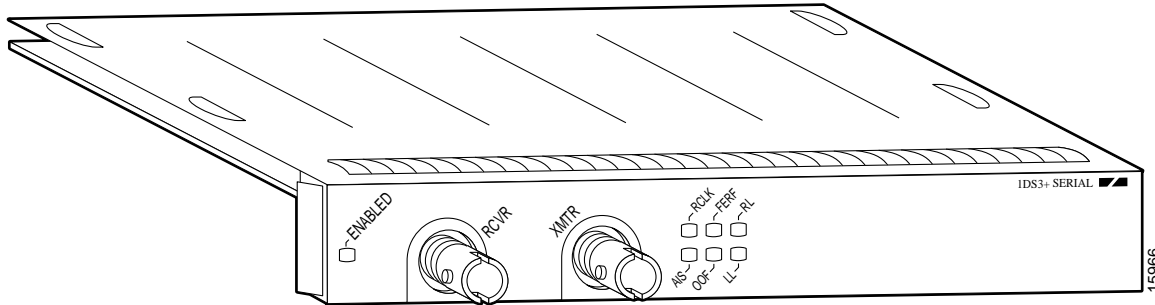
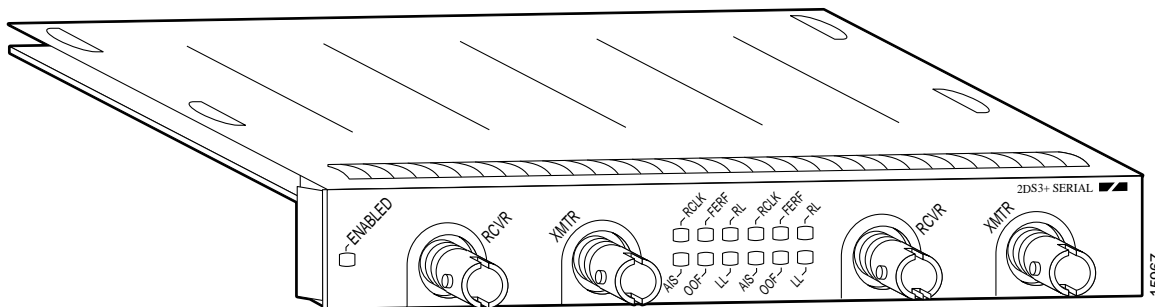


Figure 1-2 Two-Port PA-2T3+



Features

The PA-T3+ provides the following features:

- Single-wide port adapter for the following:
 - Catalyst 6000 family FlexWAN module
 - VIP in all Cisco 7000 series and Cisco 7500 series routers
 - Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router
 - Cisco 7200 series routers
 - Cisco 7301 router
 - Cisco 7401ASR router
- Single- or double-port T3+ rate (45 Mbps) connectivity
- Full-duplex synchronous serial DS3 interface
- High-Level Data Link Control (HDLC) data
- Integrated data service unit (DSU) functionality
- Support for 16- and 32-bit cyclic redundancy checks (CRCs)
- Support for C-bit, M13, and bypass framing
- Support for ATM-DXI, Frame Relay, HDLC, SMDS, and PPP serial encapsulations
- Support for DS3 MIB (RFC 1407)

- Support for remote and local loopbacks
- B3ZS line coding
- Scrambling and bandwidth reduction

Interoperability Guidelines for PA-T3+ DSUs

The PA-T3+ supports several types of integrated data service units (DSUs). [Table 1-1](#) lists the feature compatibilities of PA-T3+ DSUs.

Table 1-1 Feature Compatibilities of PA-T3+ DSUs

DSU	Full Rate Support	Scrambling Support	Subrate Support	MDL ¹ Support
DL3100	Yes	Yes	Yes	No
Kentrox	Yes	Yes ²	Yes ²	No
Larscom	Yes	Yes	Yes	No

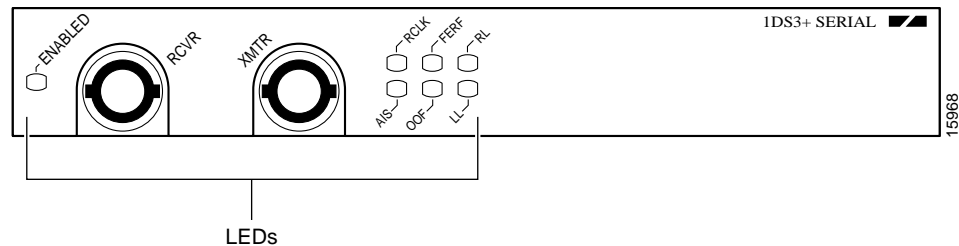
1. MDL (Maintenance Digital Link)

2. T3+ serial port adapters support scrambling and Kentrox subrate at the same time.

LEDs

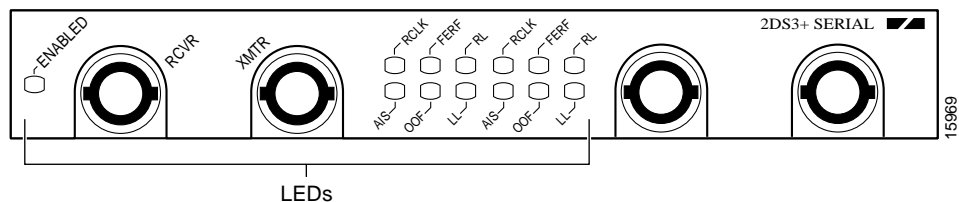
The one-port PA-T3+ has six status LEDs and one enabled LED. (See [Figure 1-3](#).)

Figure 1-3 LEDs on the One-Port PA-T3+—Horizontal Orientation



The two-port PA-T3+ has six status LEDs for each T3+ serial port and one enabled LED (See [Figure 1-4](#).)

Figure 1-4 LEDs on the Two-Port PA-2T3+—Horizontal Orientation



After system initialization, the enabled LED goes on, indicating that the port adapter has been enabled for operation.

The following conditions must be met before the PA-T3+ is enabled:

- The PA-T3+ is correctly connected and is receiving power.
- A valid software image for the port adapter has been downloaded successfully.
- The system recognizes one of the following:
 - the PA-T3+
 - a FlexWAN module with a PA-T3+
 - a VIP with a PA-T3+
 - Cisco 7304 PCI Port Adapter Carrier Card with a PA-T3+

If any of the above conditions are not met, or if the initialization fails for other reasons, the enabled LED does not go on.

Table 1-2 lists port LED colors and indications.

Table 1-2 PA-T3+ LED

LED Label	Color	State	Meaning
Enable	Green	On	Port adapter is enabled for operation.
RCLK	Green	On	A receive clock has been detected.
FERF	Yellow	On	Framer has detected a far-end receive failure.
OOF	Yellow	On	Framer has detected an out of frame failure.
AIS	Yellow	On	Framer has detected an alarm indication signal.
RL	Yellow	On	Port is in remote loopback mode.
LL	Yellow	On	Port is in local loopback mode.

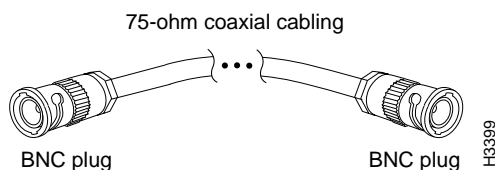
Cables and Connectors

The PA-T3+ serial interface cable, which is a 75-ohm coaxial cable, is used to connect your router to a T3+ serial network. The serial ports on the PA-T3+ are considered to be DTE devices.

The PA-T3+ has one or two T3+ serial ports, each with two connectors (receive and transmit) to which you connect the Cisco 75-ohm coaxial cable. The 75-ohm coaxial cable (Product Number CAB-ATM-DS3/E3=) for the T3+ serial port adapter is available only from Cisco Systems; it is *not* available from outside commercial cable vendors.

The Cisco T3+ 75-ohm coaxial cable (see Figure 1-5) is available only in 10-foot (3.05-meter) lengths. The typical maximum distance between stations for T3+ transmissions is up to 450 feet for 734A or equivalent coaxial cable, or up to 225 feet for 728A or equivalent coaxial cable.

Figure 1-5 T3+ Serial Port Adapter Cables



You can test the DTE-to-DCE cable connection by using the **loopback dte** command. See the [“Using loopback Commands” section on page 4-25](#), for more information.

Management Information Base

Management Information Base (MIB) attributes are readable and writable across ILMI through use of the SNMP.

The one-port PA-T3+ supports all MIB-II (RFC 1213) and the DS3 interface MIB (RFC 1407).

The two-port PA-2T3+ supports MIB-II (RFC 1213) and the DS3 interface MIB (RFC 1407).

Port Adapter Slot Locations on the Supported Platforms

This section discusses port adapter slot locations on the supported platforms. The illustrations that follow summarize slot location conventions on each platform:

- [Catalyst 6000 Family FlexWAN Module Slot Numbering, page 1-5](#)
- [Cisco 7200 Series Routers Slot Numbering, page 1-6](#)
- [Cisco 7301 Router Slot Numbering, page 1-7](#)
- [Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering, page 1-7](#)
- [Cisco 7401ASR Router Slot Numbering, page 1-8](#)
- [VIP Slot Numbering, page 1-9](#)

Catalyst 6000 Family FlexWAN Module Slot Numbering

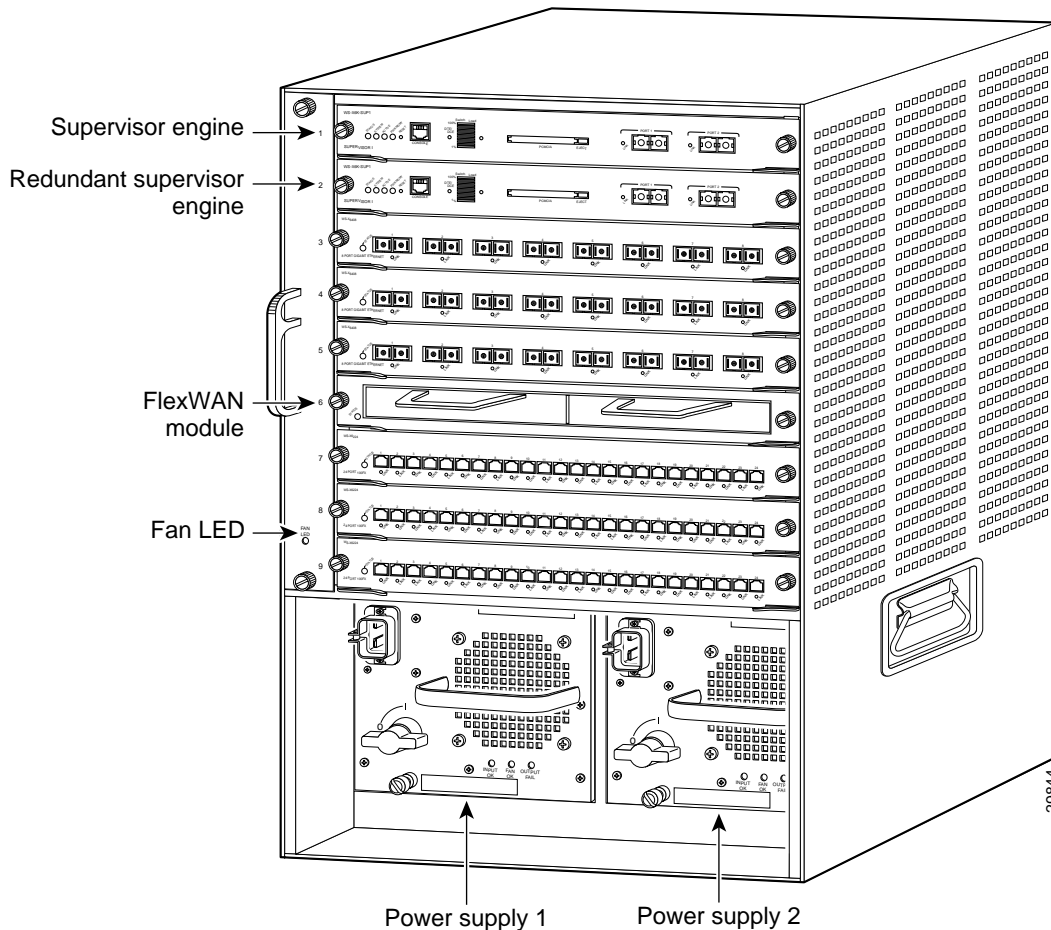
The Catalyst 6000 family FlexWAN module can be installed in any slot except slot 1, which is reserved for the supervisor engine. The PA-T3+ can be installed into either port adapter bay 0 or bay 1 on a FlexWAN module. [Figure 1-6](#) shows a FlexWAN module with two blank port adapters installed.



Note

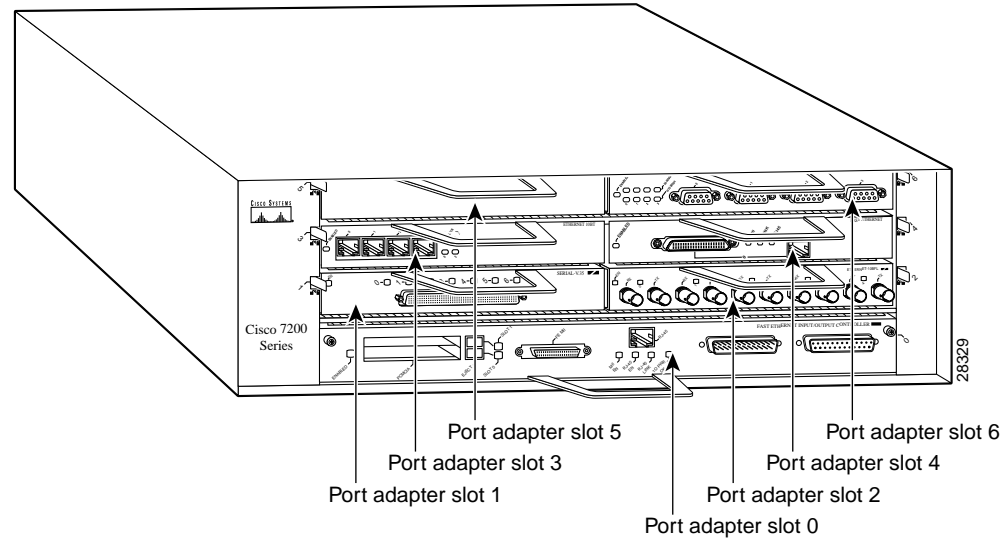
Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it would go in slot 2; otherwise, slot 2 can be used for other modules.

Figure 1-6 Catalyst 6000 Family Switch with Blank Port Adapters Installed on FlexWAN Module



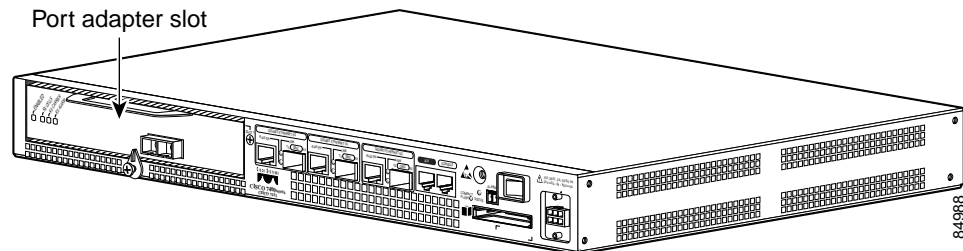
Cisco 7200 Series Routers Slot Numbering

Figure 1-7 shows a Cisco 7206 with port adapters installed. In the Cisco 7206 (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position. (The Cisco 7202 and Cisco 7204 are not shown; however, the PA-T3+ can be installed in any available port adapter slot.)

Figure 1-7 Port Adapter Slots in the 7206

Cisco 7301 Router Slot Numbering

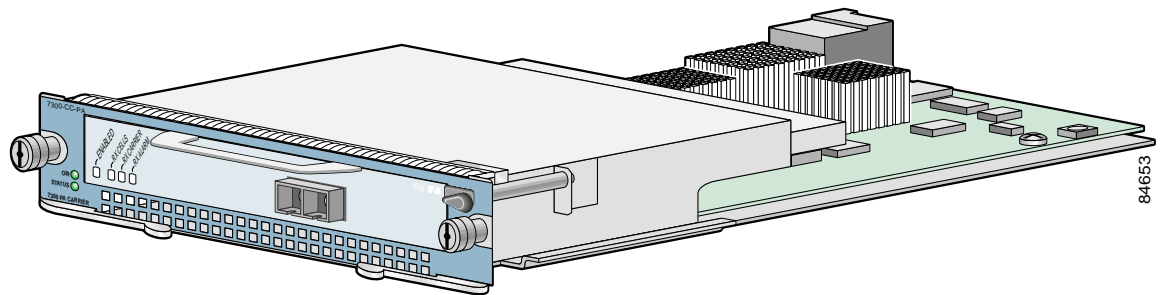
The Cisco 7301 router has one port adapter slot. See .

Figure 1-8 Port Adapter Slot on the Cisco 7301 Router

Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering

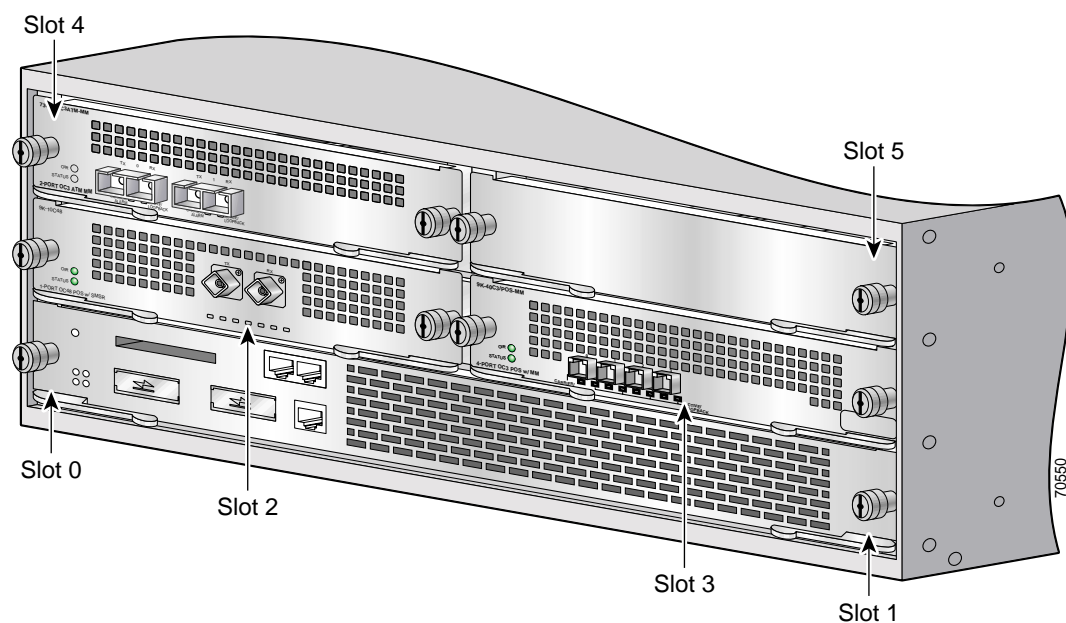
The Cisco 7304 PCI Port Adapter Carrier Card accepts one single-width port adapter. [Figure 1-9](#) shows a Cisco 7304 PCI Port Adapter Carrier Card with a port adapter installed.

Figure 1-9 Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Installed



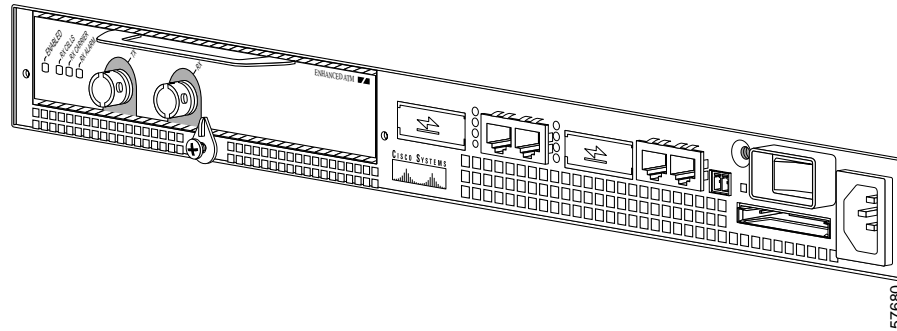
The Cisco 7304 PCI Port Adapter Carrier Card installs in Cisco 7304 router module slots 2 through 5. See [Figure 1-10](#) for module slot numbering on a Cisco 7304 router.

Figure 1-10 Module Slots on the Cisco 7304 Router



Cisco 7401ASR Router Slot Numbering

[Figure 1-11](#) shows the front view of a Cisco 7401ASR router with a port adapter installed. There is only one port adapter slot in a Cisco 7401ASR router.

Figure 1-11 Cisco 7401ASR Router with a Port Adapter Installed

VIP Slot Numbering

Figure 1-12 shows a partial view of a VIP motherboard with installed port adapters. With the motherboard oriented as shown in Figure 1-12, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1. The slots are always numbered 0 and 1.

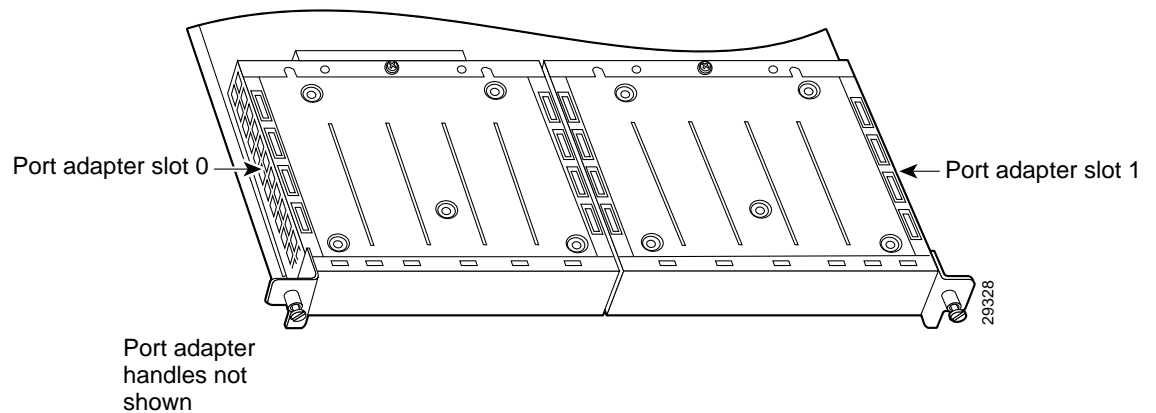
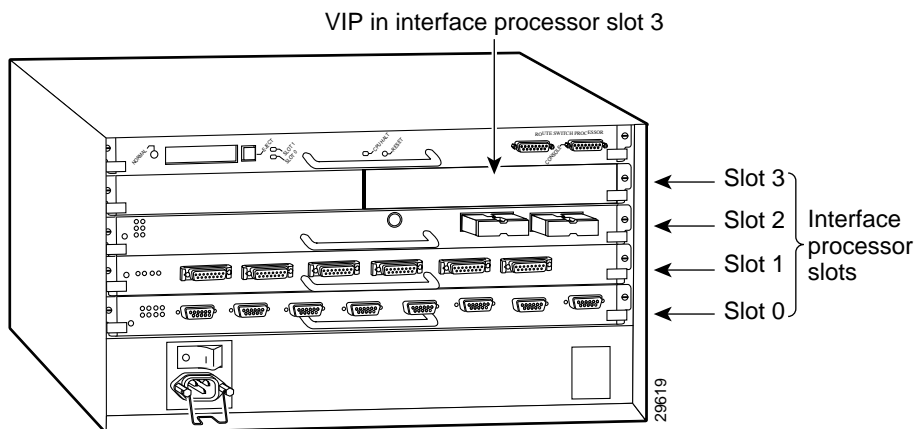
Figure 1-12 VIP Motherboard with Two Port Adapters Installed—Horizontal Orientation

Figure 1-13 shows a VIP installed in an interface processor slot of a Cisco 7505 router.

Figure 1-13 Interface Processor Slot Numbers—Cisco 7505 Shown**Note**

In the Cisco 7000, Cisco 7507, and Cisco 7513 chassis, the VIP is installed vertically. In the Cisco 7010 and Cisco 7505 chassis, the VIP is installed horizontally.

Identifying Interface Addresses

This section describes how to identify interface addresses for the PA-T3+ in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on the PA-T3+ installed in a router maintain the same address regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the first number in the interface address changes to reflect the new port adapter slot number.

Interfaces on a PA-T3+ installed in a FlexWAN module or a VIP maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a FlexWAN module or a VIP to a different slot, the interface processor slot number changes to reflect the new interface processor slot.

**Note**

Interface ports are numbered from left to right starting with 0.

[Table 1-3](#) explains how to identify interface addresses.

Table 1-3 *Identifying Interface Addresses*

Platform	Interface Address Format	Numbers	Syntax
Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	Module-slot-number/port-adapter-bay-number/interface-port-number	Module slot number—2 ¹ through 6 or 9 (depending on the number of slots in the switch) Port adapter bay—always 0 or 1 Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	3 / 0 / 0
Cisco 7200 series routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—0 through 6 (depends on the number of slots in the router) ² Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	1 / 0
Cisco 7301 routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	1 / 0
Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—router module slot 2 through 5 Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	3 / 0
Cisco 7401ASR routers	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 1 Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	1 / 0
VIP in Cisco 7000 series or Cisco 7500 series routers	Interface-processor-slot-number/port-adapter-slot-number/interface-port-number	Interface processor slot—0 through 12 (depends on the number of slots in the router) Port adapter slot—always 0 or 1 Interface port—always 0 (for the one-port PA-T3+ [=]); 0 or 1 (for the two-port PA-2T3+ [=])	3 / 1 / 0

1. Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it must go in slot 2; otherwise, slot 2 can be used for other modules.
2. Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).

Catalyst 6000 Family FlexWAN Module

This section describes how to identify the interface addresses used for the PA-4T+ on the Catalyst FlexWAN module in the Catalyst 6000 family switches. The interface address is composed of a three-part number in the format *module number/port adapter bay number/interface port number*.

See [Table 1-3](#) for the interface address format.

If the FlexWAN module is inserted in interface processor slot 3, then the interface address of the one-port PA-T3+ is 3/1/0 (module number 3, port adapter bay 1, and interfaces 0). The interface addresses of the two-port PA-2T3+ would be 3/1/0 and 3/1/1 (module number 3, port adapter bay 1, and interfaces 0 and 1).



Note

If you remove the FlexWAN module with the one-port PA-T3+ from interface processor slot 3 and install it in module number slot 6, the interface address becomes 6/1/0. The interface addresses for the two-port PA-2T3+ would be 6/1/0 and 6/1/1.



Note

The FlexWAN module physical port address begins with slot 0, which differs from the conventional Catalyst 6000 family port address, which begins with slot 1.

Cisco 7200 Series Routers Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3+ in Cisco 7200 series routers. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-3](#) for the interface address format.

In Cisco 7200 series routers, port adapter slots are numbered from the lower left to the upper right, beginning with port adapter slot 1 and continuing through port adapter slot 2 for the Cisco 7202, slot 4 for the Cisco 7204 and Cisco 7204VXR, and slot 6 for the Cisco 7206 and Cisco 7206VXR. (Port adapter slot 0 is reserved for the optional Fast Ethernet port on the I/O controller—if present.)

The interface address of the interface on the one-port PA-T3+(=) in port adapter slot 1 is 1/0 (port adapter slot 1 and interface 0). If the PA-T3+(=) was in port adapter slot 4, this same interface would be numbered 4/0 (port adapter slot 4 and interfaces 0).

The interface addresses of the interfaces on the two-port PA-2T3+(=) in port adapter slot 1 are 1/0 through 1/1 (port adapter slot 1 and interface 0 or 1). If the PA-2T3+(=) was in port adapter slot 4, these same interfaces would be numbered 4/0 through 4/1 (port adapter slot 4 and interfaces 0 through 1).

Cisco 7301 Router Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3+ in a Cisco 7301 router. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-3](#) for the interface address format.

Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3+ and PA-2T3+ in the Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 routers. The interface address is made of a two-part number in the format *port-adapter-slot-number/interface-port-number*.

The Cisco 7304 PCI Port Adapter Carrier Card installs into Cisco 7304 router module slots 2 through 5 (See [Figure 1-10](#).) The port-adapter-slot-number is the Cisco 7304 router module slot number. For example, the interface address of port 0 on a PA-T3+, in which the Cisco 7304 PCI Port Adapter Carrier Card is installed in Cisco 7304 router module slot 3, would be numbered 3/0.

Cisco 7401ASR Router Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3+ in a Cisco 7401ASR router. The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See [Table 1-3](#) for the interface address format.

VIP Interface Addresses

This section describes how to identify the interface addresses used for the PA-T3+ on a VIP in Cisco 7000 series and Cisco 7500 series routers.

**Note**

Although the processor slots in the 7-slot Cisco 7000 and Cisco 7507 and the 13-slot Cisco 7513 and Cisco 7576 are vertically oriented and those in the 5-slot Cisco 7010 and Cisco 7505 are horizontally oriented, all Cisco 7000 series and Cisco 7500 series routers use the same method for slot and port numbering.

See [Table 1-3](#) for the interface address format. The interface address is composed of a three-part number in the format *interface-processor-slot-number/port-adapter-slot-number/interface-port-number*.

If the VIP is inserted in interface processor slot 3, then the interface address of the one-port PA-T3+(=) is 3/1/0 (interface processor slot 3, port adapter slot 1, and interfaces 0). The interface addresses of the two-port PA-2T3+(=) would be 3/1/0 and 3/1/1 (interface processor slot 3, port adapter slot 1, and interfaces 0 and 1).

**Note**

If you remove the VIP with the one-port PA-T3+(=) from interface processor slot 3 and install it in interface processor slot 2, the interface address becomes 2/1/0. The interface addresses for the two-port PA-2T3+(=) would be 2/1/0 and 2/1/1.



Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the PA-T3+ port adapter. This chapter contains the following sections:

- [Required Tools and Equipment, page 2-1](#)
- [Software and Hardware Requirements, page 2-2](#)
- [75-Ohm In-Line Coaxial Attenuator, page 2-3](#)
- [Checking Hardware and Software Compatibility, page 2-3](#)
- [Safety Guidelines, page 2-3](#)

Required Tools and Equipment

You need the following tools and parts to install a port adapter. If you need additional equipment, contact a service representative for ordering information.

- PA-T3+ serial port adapter.
- Catalyst 6000 family FlexWAN module.
- VIP (for installation in Cisco 7000 series or Cisco 7500 series chassis only). For information about the specific VIP models that support the PA-T3+, see the [“Software and Hardware Requirements” section on page 2-2](#).
- Cisco 7304 PCI Port Adapter Carrier Card (for installation in a Cisco 7304 router).
- 75-ohm coaxial serial interface cables.
- Number 1 Phillips and a 3/16-inch, flat-blade screwdriver (for VIP installation only).
- Number 2 Phillips screwdriver.
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares.
- Antistatic mat.
- Antistatic container.
- Attenuator kit (optional).

Software and Hardware Requirements

Table 2-1 lists the recommended minimum Cisco IOS software release required to use the one-port PA-T3(=) and two-port PA-2T3(=) in supported router platforms.

Table 2-1 PA-T3+ Software Requirements

Router Platform	Recommended Minimum Cisco IOS Release (PA-T3+[=] and PA-2T3+[=])
Catalyst 6000 family switches with Catalyst 6000 family FlexWAN module <ul style="list-style-type: none"> Catalyst 6000 family MSFC¹ Supervisor engine software 	Cisco IOS Release 12.1(1)EX or later Catalyst 6000 Family Supervisor Engine Software release 5.4(1) or later
Cisco 7200 series <ul style="list-style-type: none"> Cisco 7202, Cisco 7204, and Cisco 7206 Cisco 7204VXR, and Cisco 7206VXR 	Cisco IOS Release 11.1(24)CC or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
Cisco 7301 routers	Cisco IOS Release 12.2(11)YZ or a later release of Cisco IOS Release 12.2 YZ
Cisco 7304 routers <ul style="list-style-type: none"> With Cisco 7304 PCI Port Adapter Carrier Card 	Cisco IOS Release 12.2(14)SZ or a later release of Cisco IOS Release 12.2SZ
Cisco 7401ASR routers	Cisco IOS Release 12.2(1)DX or a later release of Cisco IOS Release 12.2 DX Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2 B
VIP^{2 3 4} in the Cisco 7000 series and Cisco 7500 series	Cisco IOS Release 11.1(24)CC or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T Cisco IOS Release 12.0(10)S or a later release of Cisco IOS Release 12.0(10)S Cisco IOS Release 12.0(10)S or a later release of Cisco IOS Release 12.0(10)S

1. MFSC = Multilayer Switch Feature Card
2. The PA-T3+ is considered a *high-bandwidth* port adapter. The specific VIP2 model recommended for the PA-T3+ in all Cisco 7000 series routers using the RSP7000 and RSP7000CI is the VIP2-15, which has 1 MB of SRAM and 8 MB of DRAM. Installation of the PA-T3+ on the VIP2-10 (with 512 KB of SRAM and 8 MB of DRAM) is not recommended.
3. The PA-T3+ is considered a *high-bandwidth* port adapter. The specific VIP2 model recommended for the PA-T3+ in all Cisco 7000 series routers using the RSP7000 and RSP7000CI is the VIP2-15, which has 1 MB of SRAM and 8 MB of DRAM. Installation of the PA-T3+ on the VIP2-10 (with 512 KB of SRAM and 8 MB of DRAM) is not recommended.
4. The VIP4 provides 64 or 256 MB of 100-MHz synchronous dynamic random-access memory (SDRAM) as the central processing unit (CPU) memory (also called program memory), and 64 of 100-MHz SDRAM as the packet memory



Caution

The VIP requires that the host Cisco 7000 series router have the RSP7000 and RSP7000CI installed. The VIP will not operate properly with the Route Processor (RP), Switch Processor (SP), or Silicon Switch Processor (SSP) installed in the host Cisco 7000 series router.

For Cisco configuration guidelines in the Cisco 7200 series, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.

75-Ohm In-Line Coaxial Attenuator

A 75-ohm in-line coaxial attenuator may be required to tune the signal between the PA-T3+ and the far-end equipment, if the port adapter is experiencing line code violations (LCVs). LCVs occur when the far-end equipment transmit signal saturates the front-end receiver of the PA-T3+.

Cisco offers an attenuator kit (ATTEN-KIT-PA=) that contains five attenuators with fixed values ranging from 3 dB to 20 dB. For more information on the attenuator kit, go to the following website:

<http://www.cisco.com/univercd/cc/td/doc/product/core/7206/fru/12884att.htm>

Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum IOS requirements for individual hardware modules or components.



Note

Access to this tool is limited to users with Cisco.com login accounts.

To access Software Advisor, click **Login** at Cisco.com and go to **Technical Support Help—Cisco TAC: Tool Index: Software Advisor**. You can also access the tool by pointing your browser directly to <http://www.cisco.com/cgi-bin/support/CompNav/Index.pl>.

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Safety Guidelines

This section provides safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.



Warning

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Waarschuwing

BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus

TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung WICHTIGE SICHERHEITSANWEISUNGEN

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem! FONTOS BIZTONSÁGI ELŐÍRÁSOK

Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielőtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ŐRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban találhatók.

Avvertenza IMPORTANTI ISTRUZIONI SULLA SICUREZZA

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GUARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GUARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

Varning! VIKTIGA SÄKERHETSANVISNINGAR

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

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Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedure requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis; do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.

- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe; carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Port adapters and processor modules consist of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed board component-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap protects components from ESD voltages on the body only; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.



Caution

For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohm).



Removing and Installing Port Adapters

This chapter describes how to remove the PA-T3+ port adapter from supported platforms and also how to install a new or replacement port adapter. This chapter contains the following sections:

- [Handling Port Adapters, page 3-1](#)
- [Online Insertion and Removal, page 3-2](#)
- [Warnings and Cautions, page 3-3](#)
- [Port Adapter Removal and Installation, page 3-4](#)
- [Connecting a Serial Cable, page 3-12](#)

Each port adapter circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.



Note

When port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove the blank port adapter.



Caution

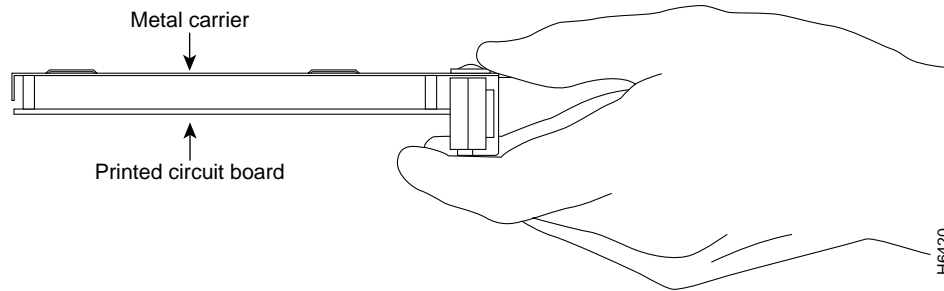
When powering off the router, wait a minimum of 30 seconds before powering it on again.

Handling Port Adapters



Caution

Always handle the port adapter by the carrier edges and handle; never touch the port adapter components or connector pins. (See [Figure 3-1](#).)

Figure 3-1 Handling a Port Adapter

Online Insertion and Removal

Several platforms support online insertion and removal (OIR) of port adapters. Cisco 7200 series routers support OIR for all port adapter types, therefore you do not have to power down routers when removing and replacing a PA-T3+ on Cisco 7200 series routers, Cisco 7301 routers, or Cisco 7401ASR routers.

Although the Catalyst 6000 family FlexWAN module, the VIP, and the Cisco 7304 PCI Port Adapter Carrier Card support online insertion and removal, individual port adapters do not. To replace port adapters, you must first remove the FlexWAN module, the VIP, or the Cisco 7304 PCI Port Adapter Carrier Card from the router and then replace port adapters as required. If a blank port adapter is installed on the FlexWAN module, the VIP, or the Cisco 7304 PCI Port Adapter Carrier Card on which you want to install a new port adapter, you must first remove the FlexWAN module, the VIP, or the Cisco 7304 PCI Port Adapter Carrier Card from the router and then remove the blank port adapter.

**Caution**

To prevent system problems, do not remove port adapters from the FlexWAN module, the VIP, and the Cisco 7304 PCI Port Adapter Carrier Card or attempt to install other port adapters when the system is operating. To install or replace port adapters, first remove the FlexWAN module, the VIP, or the Cisco 7304 PCI Port Adapter Carrier Card from the router.

It is wise to gracefully shut down the system before removing a port adapter that has active traffic moving through it. Removing a module while traffic is flowing through the ports can cause system disruption. Once the module is inserted, the ports can be brought back up.

**Note**

As you disengage the module from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the module.

OIR allows you to install and replace modules while the router is operating; you do not need to notify the software or shut down the system power, although you should not run traffic through the module you are removing while it is being removed. OIR is a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a module in a supported platform, refer to the [“Port Adapter Removal and Installation”](#) section on page 3-4.

Each module has a bus connector that connects it to the router. The connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the module. The system assesses the signals it receives and the order in which it receives them to determine if a module is being removed from or introduced to the system. From these signals, the system determines whether to reinitialize a new interface or to shut down a disconnected interface.

Specifically, when you insert a module, the longest pins make contact with the module first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a module, the pins send signals to notify the system of changes. The router then performs the following procedure:

1. Rapidly scans the system for configuration changes.
2. Initializes newly inserted port adapters or administratively shuts down any vacant interfaces.
3. Brings all previously configured interfaces on the module back to their previously installed state. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar module type is reinserted into a slot, its ports are configured and brought online up to the port count of the originally installed module of that type.

**Note**

Before you begin installation, read [Chapter 2, “Preparing for Installation”](#) for a list of parts and tools required for installation.

Warnings and Cautions

Observe the following warnings and cautions when installing or removing port adapters.

**Caution**

Do not slide a port adapter all the way into the slot until you have connected all required cables. Trying to do so disrupts normal operation of the router or switch.

**Note**

If a port adapter lever or other retaining mechanism does not move to the locked position, the port adapter is not completely seated in the midplane. Carefully pull the port adapter halfway out of the slot, reinsert it, and move the port adapter lever or other mechanism to the locked position.

**Caution**

To prevent jamming the carrier between the upper and the lower edges of the port adapter slot, and to ensure that the edge connector at the rear of the port adapter mates with the connection at the rear of the port adapter slot, make certain that the carrier is positioned correctly, as shown in the cutaway in the following illustrations.

**Warning**

When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.

Port Adapter Removal and Installation

In this section, the illustrations that follow give step-by-step instructions on how to remove and install port adapters. This section contains the following illustrations:

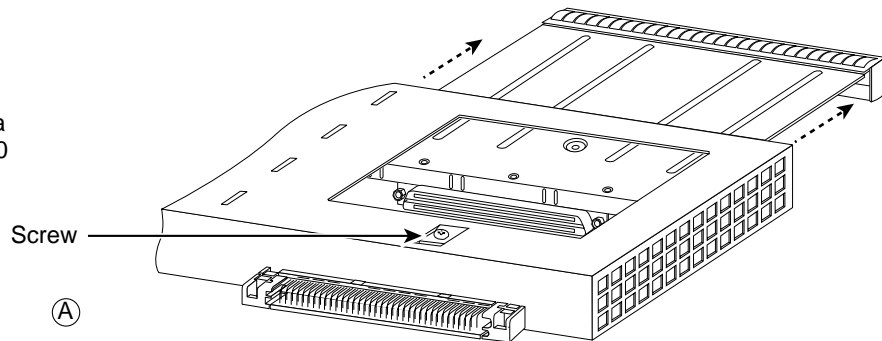
- [FlexWAN Module—Removing and Installing a Port Adapter, page 3-5](#)
- [Cisco 7200 Series—Removing and Installing a Port Adapter, page 3-6](#)
- [Cisco 7301 Router—Removing and Installing a Port Adapter, page 3-7](#)
- [Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter, page 3-8](#)
- [Cisco 7401ASR Router—Removing and Installing a Port Adapter, page 3-10](#)
- [VIP—Removing and Installing a Port Adapter, page 3-11](#)

FlexWAN Module—Removing and Installing a Port Adapter

Note: You must first remove the Catalyst 6000 FlexWAN module from the chassis before removing a port adapter from the Catalyst 6000 FlexWAN module.

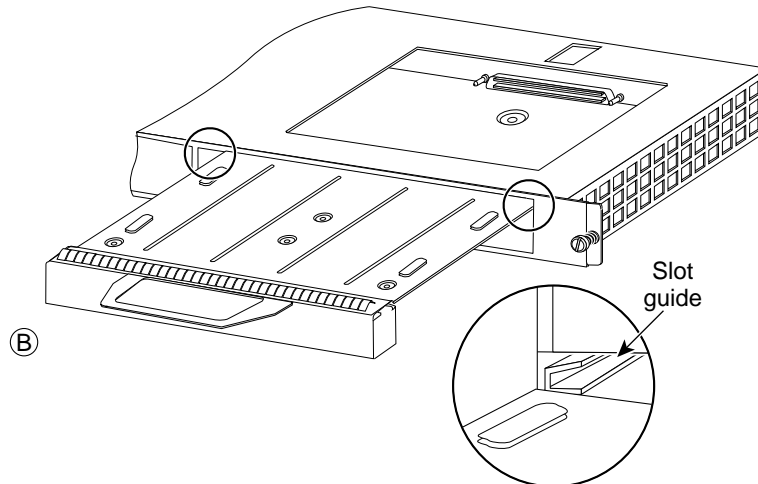
Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)



Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its bay, away from the edge connector at the rear of the bay. (See A.)



Step 3

To install the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter bay. (See B.)

Step 4

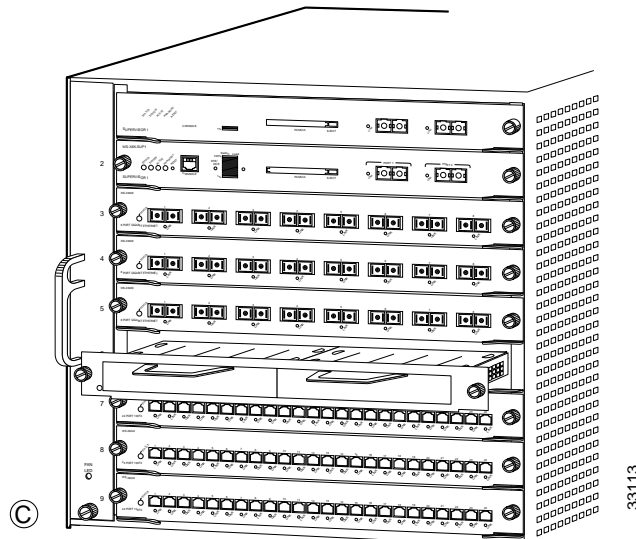
Carefully slide the new port adapter into the port adapter bay until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 5

Install the screw in the rear of the port adapter bay. Do not overtighten the screw. (See A.)

Step 6

Reinstall the Catalyst 6000 FlexWAN module in the chassis, and tighten the captive installation screw on each side of the Catalyst 6000 FlexWAN module faceplate. (See C.)



Cisco 7200 Series—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, place the port adapter lever in the unlocked position. (See A.) The port adapter lever remains in the unlocked position.

Step 2

Grasp the handle of the port adapter and pull the port adapter from the router, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 3

With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Step 4

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

Step 5

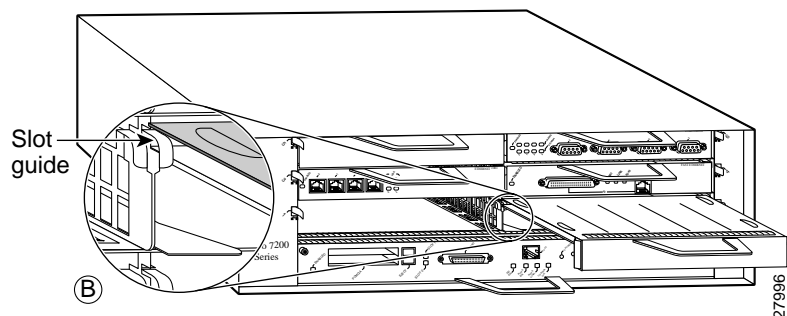
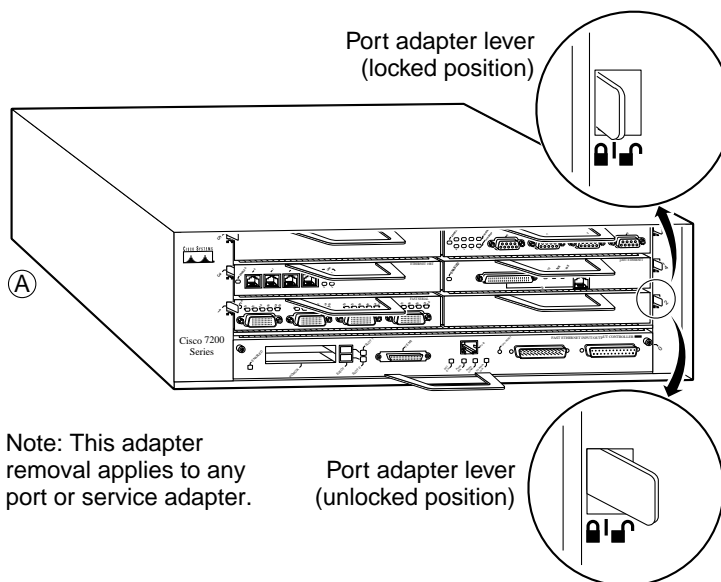
Carefully slide the new port adapter halfway into the port adapter slot. (See B.)

Step 6

With the port adapter halfway into the slot, connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane.

Step 7

After the port adapter is properly seated, lock the port adapter lever. (See A.)



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Cisco 7301 Router—Removing and Installing a Port Adapter

Step 1

Use an ESD wrist strap to ground yourself to the router.

Step 2

To remove a port adapter, use a Phillips screwdriver to turn the screw holding the port adapter latch. The screw should be loose enough to allow the latch to rotate to an unlocked position. (See A.) The latch can rotate 360°.

Step 3

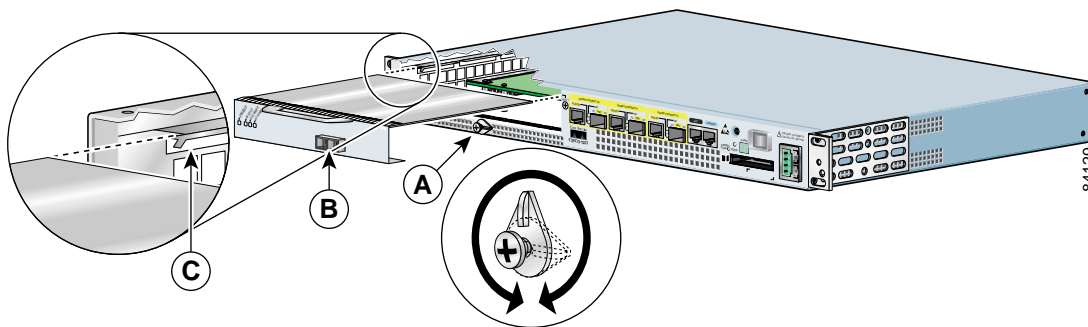
Grasp the handle and pull the port adapter from the router, about halfway out of its slot. (See B.) If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 4

With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Caution

The port adapter must slide into the slot guides close to the chassis lid. (See C.) Do not allow the port adapter components to come in contact with the system board or the port adapter could be damaged.

**Step 5**

To insert the port adapter, carefully align the port adapter carrier in the slot guides. (See C.) Slide the new port adapter halfway into the chassis.

Step 6

Connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the midplane.

Step 7

After the port adapter is properly seated, turn and secure the port adapter latch in the upright, locked position. (See A.) Tighten the screw to ensure the port adapter remains firmly in place.

Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter

You can install one single-width port adapter in a Cisco 7304 PCI Port Adapter Carrier Card. This section provides step-by-step instructions for removing and installing a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.



Warning

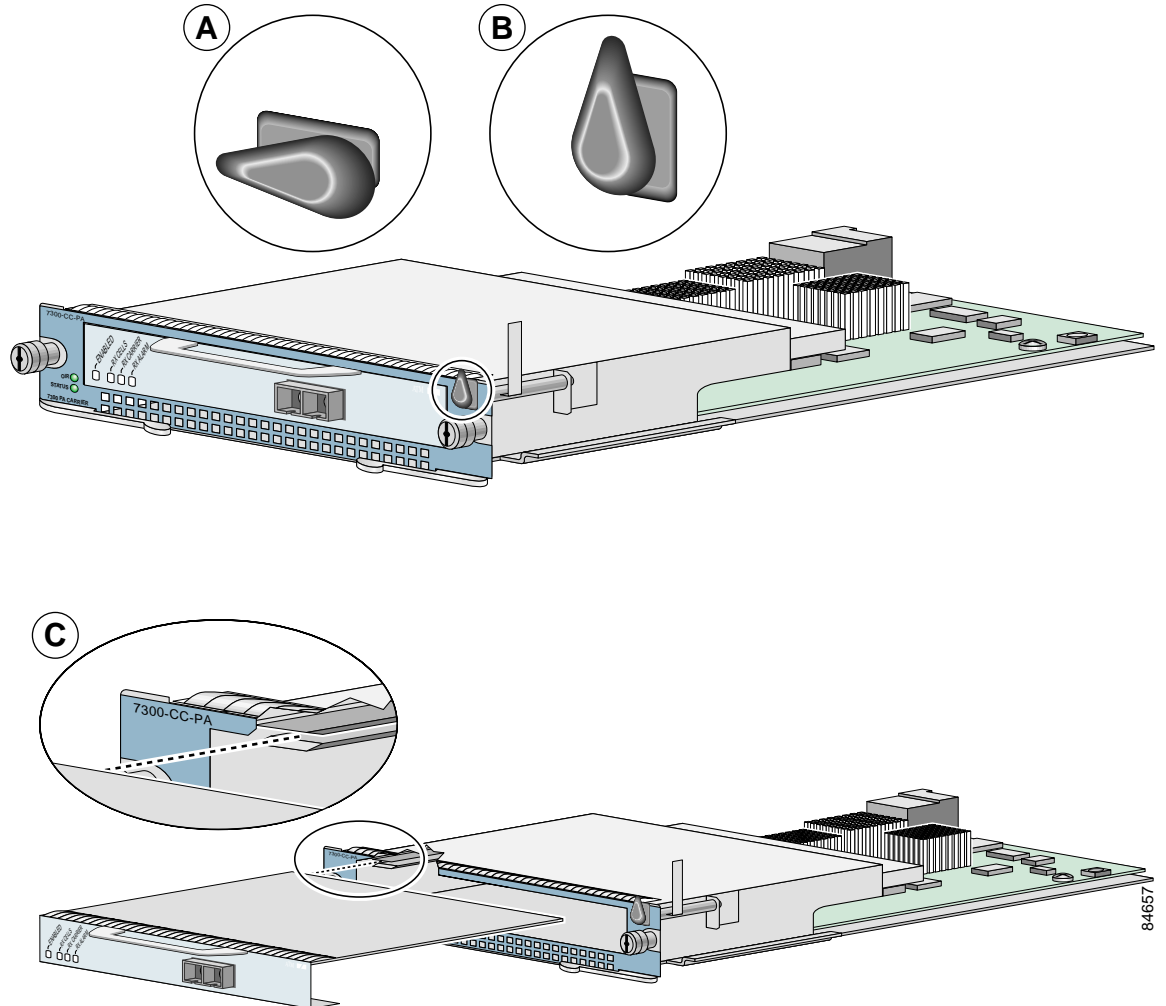
When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the Cisco 7304 PCI Port Adapter Carrier Card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.

To remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card, refer to [Figure 3-2](#) and do the following:

-
- Step 1** If the Cisco 7304 PCI Port Adapter Carrier Card is still in the router, you must remove the Cisco 7304 PCI Port Adapter Carrier Card before removing a port adapter.
 - Step 2** To remove the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card, turn the port adapter lock from its locked and horizontal position shown in A of [Figure 3-2](#) to its unlocked and vertical position shown in B of [Figure 3-2](#).
 - Step 3** Grasp the handle of the port adapter and pull the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card. (You have already disconnected the cables from the port adapter when removing the Cisco 7304 PCI Port Adapter Carrier Card).
 - Step 4** To insert the port adapter in the Cisco 7304 PCI Port Adapter Carrier Card, locate the guide rails inside the Cisco 7304 PCI Port Adapter Carrier Card that hold the port adapter in place. They are at the top left and top right of the port adapter slot and are recessed about an inch, as shown in C of [Figure 3-2](#).
 - Step 5** Carefully slide the port adapter in the Cisco 7304 PCI Port Adapter Carrier Card until the port adapter makes contact with the port adapter interface connector. When fully seated, the port adapter front panel should be flush with the face of the Cisco 7304 PCI Port Adapter Carrier Card.
 - Step 6** After the port adapter is properly seated, turn the port adapter lock to its locked and horizontal position, as shown in A of [Figure 3-2](#).
-

Figure 3-2 illustrates how to remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.

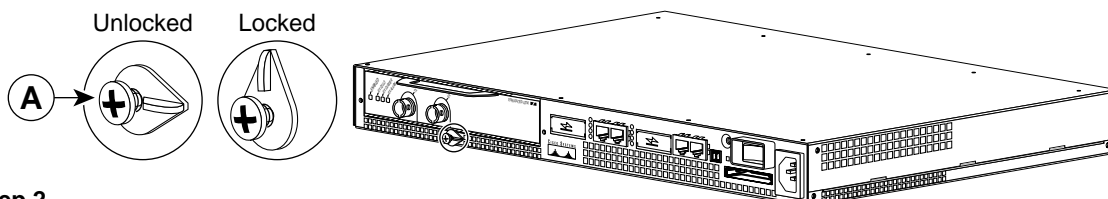
Figure 3-2 Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Removal and Installation



Cisco 7401ASR Router—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, use a number 2 Phillips screwdriver to loosen the screw on the port adapter latch. Rotate the port adapter latch until it clears the faceplate of the port adapter. (See A.) The latch can rotate 360°.



Step 2

Pull the port adapter from the router, about halfway out of its slot. (If you remove a blank port adapter, keep the blank port adapter for use in the router if you should ever remove the port adapter. The port adapter slot must always be filled.)

Step 3

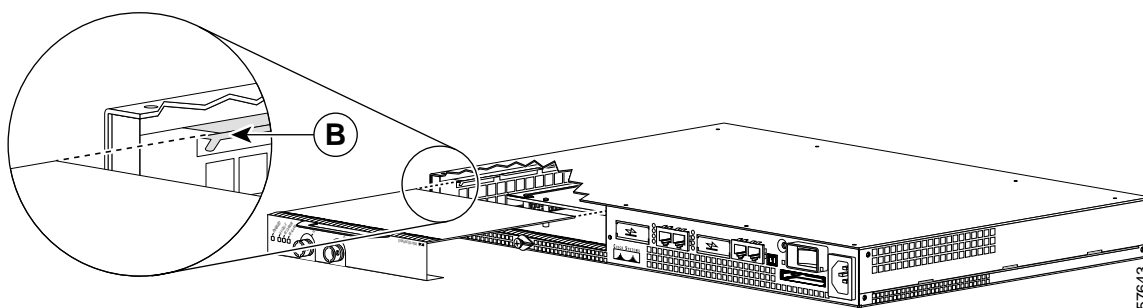
With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter completely out of the chassis slot.

Step 4

To insert the port adapter, locate the port adapter slot guides inside the Cisco 7401ASR router. They are near the top, and are recessed about 1/2 inch. (See B.)

Caution

The port adapter must slide into the slot guides under the chassis lid. Do not allow the port adapter components to come in contact with the system board, or the port adapter could be damaged.



Step 5

Insert the port adapter in the slot guides halfway, and then reconnect the port adapter cables.

Step 6

After the cables are connected, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane. When installed, the port adapter input/output panel should be flush with the face of the router.

Step 7

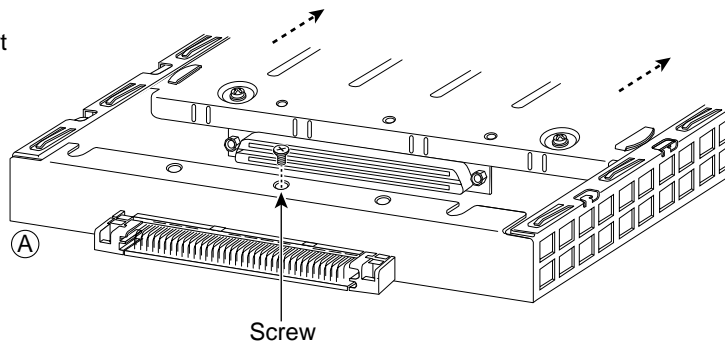
After the port adapter is properly seated, rotate the port adapter latch to the upright locked position and use a number 2 Phillips screwdriver to tighten the latch screw. If needed, loosen the latch screw to rotate the latch over the port adapter. Finish the installation by tightening the latch screw.

VIP—Removing and Installing a Port Adapter

Note: You must first remove the VIP from the chassis before removing a port adapter from the VIP.

Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)

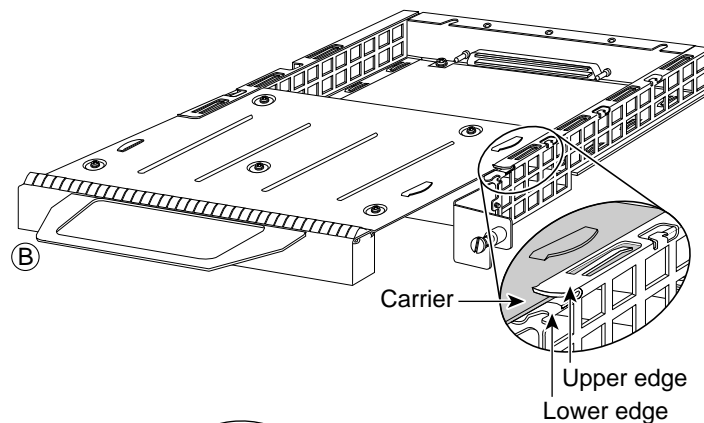


Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)

Step 3

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

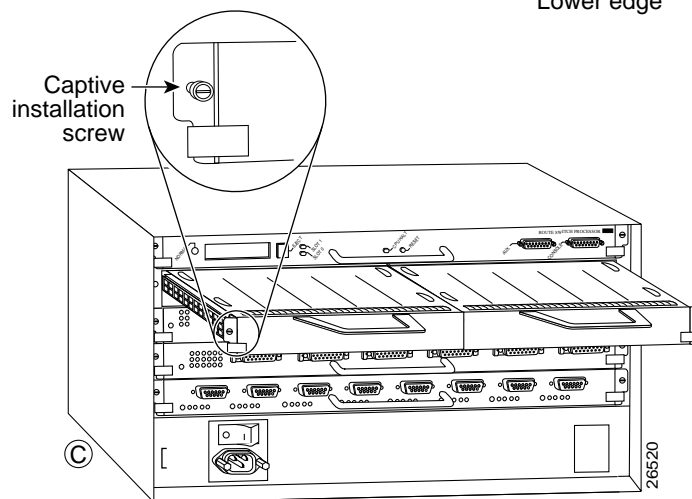


Step 4

Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 5

Install the screw in the rear of the port adapter slot on the VIP. Do not overtighten the screw. (See A.)



Step 6

Carefully slide the VIP motherboard into the interface processor slot until the connectors at the rear of the VIP are completely seated in the connectors at the rear of the interface processor slot. Use the ejector levers to seat the VIP in the interface processor slot. Tighten the captive installation screws on the VIP. (See C.)

Connecting a Serial Cable

On a single one-port PA-T3+(=), you can use two 75-ohm coaxial cables (one for the receive port [RCVR] and one for the transmit [XMTR] port). You can use four 75-ohm coaxial cables on the two-port PA-2T3+(=). Cisco 75-ohm coaxial cables are available *only* from Cisco Systems.



Caution

You can attach only an EIA/TIA-612 or EIA/TIA-613 serial cable to the PA-T3+ installed in your router. Attaching a serial coaxial cable of another interface type to the port adapter could damage your router or the hardware at the network end of the cable.

Each T3 link requires separate receive and transmit connections to your external T3 equipment.

To connect the 75-ohm coaxial cables to the PA-T3+ port adapter, follow these steps:

Step 1

Attach the 75-ohm coaxial cables directly to the BNC ports on the PA-T3+. Attach one end of a cable to the port labeled XMTR and one end of a second cable to the port labeled RCVR. (See [Figure 3-3](#).)

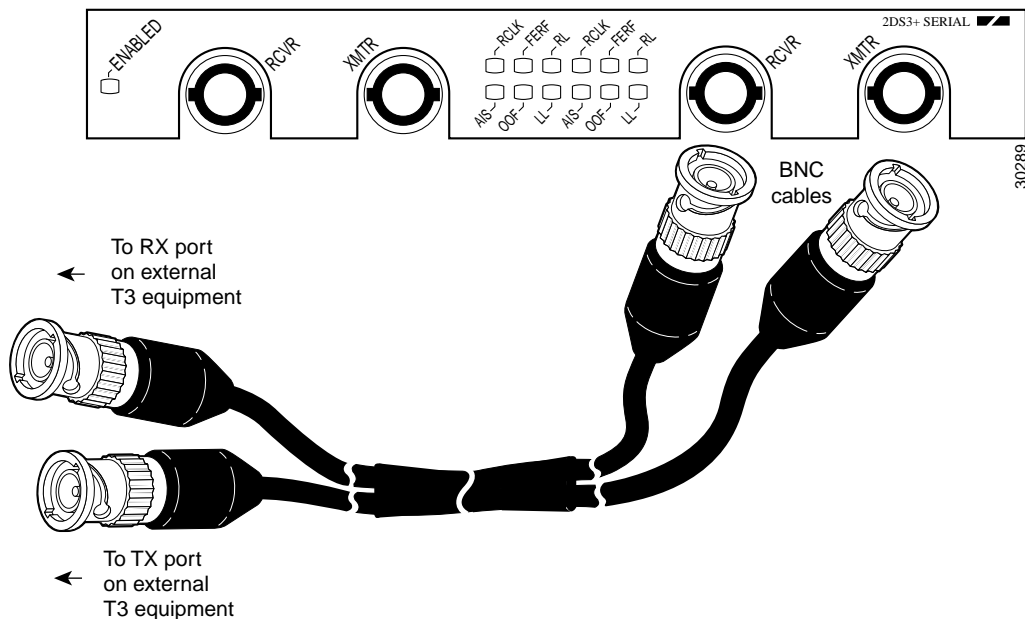


Note

We strongly recommend that you fasten together your transmit and receive cables along their entire length, as shown in . Doing so reduces the effects of EMI. You can use standard heat-activated shrink tubing or cable ties for this purpose.

You can also use a 75-ohm coaxial cable pair that is available from Cisco Systems (Product Number CAB-ATM-DS3/E3[=]).

Figure 3-3 Attaching 75-ohm Coaxial Cables to a PA-T3+



Caution

To prevent system problems and to maintain the proper cable connection sequences, connect the receive and transmit ports on your PA-T3+ as indicated in Step 2.

- Step 2** Attach the network ends of your two 75-ohm coaxial cables to your external T3 equipment as follows:
- Attach the coaxial cable from the PA-T3+ XMTR port to the RX port on your external T3 equipment.
 - Attach the coaxial cable from the PA-T3+ RCVR port to the TX port on your external T3 equipment.
-



Configuring the PA-T3+

To continue your PA-T3+ port adapter installation, you must configure the serial interfaces. The instructions that follow apply to all supported platforms. Minor differences between the platforms—with Cisco IOS software commands—are noted.

This chapter contains the following sections:

- [Using the EXEC Command Interpreter, page 4-1](#)
- [Configuring the Interfaces, page 4-2](#)
- [Configuring Half-Duplex and Binary Synchronous Communications in Cisco 7200 Series Routers, page 4-13](#)
- [Checking the Configuration, page 4-16](#)

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the *EXEC* (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

-
- | | |
|---------------|---|
| Step 1 | At the user-level EXEC prompt, enter the enable command. The EXEC prompts you for a privileged-level password as follows:

<pre>Router> enable</pre>
<pre>Password:</pre> |
| Step 2 | Enter the password (the password is case sensitive). For security purposes, the password is not displayed. When you enter the correct password, the system displays the privileged-level system prompt (#):

<pre>Router#</pre> |
-

To configure the new interfaces, proceed to the [“Configuring the Interfaces” section on page 4-2](#).

Configuring the Interfaces

After you verify that the new PA-T3+ is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure the new interfaces. Have the following information available:

- T3+ information such as clock source and framing type
- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing
- Bridging protocols you plan to use
- Timing source for each new interface and clock speeds for external timing

If you installed a new PA-T3+ or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a PA-T3+ that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configuration.

For a summary of the configuration options available and instructions for configuring interfaces on a PA-T3+, refer to the appropriate configuration publications listed in the [“Related Documentation” section on page viii](#).

You execute configuration commands from the privileged level of the EXEC command interpreter, which usually requires password access. Contact your system administrator, if necessary, to obtain password access. (See the [“Using the EXEC Command Interpreter” section on page 4-1](#) for an explanation of the privileged level of the EXEC.)

This section contains the following subsections:

- [Shutting Down an Interface, page 4-2](#)
- [Performing a Basic Configuration, page 4-6](#)
- [Configuring Timing \(Clock\) Signals, page 4-8](#)
- [Configuring NRZI Format, page 4-11](#)
- [Configuring Cyclic Redundancy Checks, page 4-12](#)
- [Setting the Bandwidth, page 4-15](#)
- [Defining the DSU Mode, page 4-15](#)
- [Enabling T3+ Scrambling, page 4-16](#)
- [Specifying T3+ Framing, page 4-16](#)
- [Setting the Cable Length, page 4-16](#)

Shutting Down an Interface

Before you remove an interface that you will not replace, or replace port adapters, use the **shutdown** command to shut down (disable) the interfaces to prevent anomalies when you reinstall the new or reconfigured interface processor. When you shut down an interface, it is designated *administratively down* in the **show** command displays.

Follow these steps to shut down an interface:

- Step 1** Enter the privileged level of the EXEC command interpreter (also called enable mode). (See the [“Using the EXEC Command Interpreter”](#) section on page 4-1 for instructions.)
- Step 2** At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:
- ```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```
- Step 3** Shut down interfaces by entering the **interface serial** subcommand (followed by the interface address of the interface), and then enter the **shutdown** command. [Table 4-1](#) shows the command syntax.
- When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter.

**Table 4-1** Syntax of the shutdown Command

| Platform                                                             | Command                                                                                                                                                  | Example                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches | <b>interface</b> , followed by the type ( <b>serial</b> ) and <i>mod_num/bay/port</i> (module-slot-number/port-adapter-bay-number/interface-port-number) | The example is for interface 0 and interface 1 on a port adapter in bay 0 of a FlexWAN module installed in module slot 3.<br><br>Router(config-if)# <b>interface serial 3/0/0</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 3/0/1</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router#                           |
| Cisco 7200 series routers                                            | <b>interface</b> , followed by the type ( <b>serial</b> ) and <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                          | The example is for interface 0 and interface 1 on a port adapter in port adapter slot 6.<br><br>Router(config-if)# <b>interface serial 6/0</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 6/1</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router#                                                                |
| Cisco 7301 routers                                                   | <b>interface</b> , followed by the type ( <b>serial</b> ) and <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                          | The example is for interface 0 and interface 1 on a port adapter in port adapter slot 1.<br><br>Router(config-if)# <b>interface serial 1/0</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 1/1</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router#                                                                |
| Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router      | <b>interface</b> , followed by the type ( <b>serial</b> ) and <i>slot/port</i> (module-slot-number/interface-port-number)                                | The example is for interface 0 and interface 1 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.<br><br>Router(config-if)# <b>interface serial 3/0</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 3/1</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router# |

Table 4-1 Syntax of the shutdown Command (continued)

| Platform                                              | Command                                                                                                                                                                    | Example                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco 7401ASR router                                  | <b>interface</b> , followed by the <i>type (serial)</i> and <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                                              | The example is for the 0 interface and interface 1 on a port adapter in slot 1.<br><br>Router(config)# <b>interface serial 1/0</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 1/1</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router#                                                                  |
| VIP in Cisco 7000 series or Cisco 7500 series routers | <b>interface</b> , followed by the <i>type (serial)</i> and <i>slot/port adapter/port</i> (interface-processor-slot-number port-adapter-slot-number/interface-port-number) | The example is for interface 1 and interface 0 on a port adapter in port adapter slot 1 of a VIP installed in interface processor slot 1.<br><br>Router(config-if)# <b>interface serial 1/1/1</b><br>Router(config-if)# <b>shutdown</b><br>Router(config-if)# <b>interface serial 1/1/0</b><br>Router(config-if)# <b>shutdown</b><br><b>Ctrl-Z</b><br>Router# |

**Note**

If you need to shut down additional interfaces, enter the **interface serial** command (followed by the interface address of the interface) for each of the interfaces on your port adapter. Use the **no shutdown** command to enable the interface.

**Step 4** Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored in NVRAM.

**Step 5** Verify that new interfaces are now in the correct state (shut down) using the **show interfaces** command (followed by the interface type and interface address of the interface) to display the specific interface. [Table 4-2](#) provides examples.



**Table 4-2** Examples of the *show interfaces serial* Command

| Platform                                                             | Command                                                                                                                                | Example                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches | <b>show interfaces serial</b> , followed by <i>mod_num/bay/port</i> (module-slot-number/port-adapter-bay-number/interface-port-number) | <p>The example is for interface 0 on a port adapter in bay 0 of a FlexWAN module in module slot 3.</p> <pre>Router# show interfaces serial 3/0/0</pre> <p>Serial 3/0/0 is administratively down,<br/>line protocol is down</p> <p>[Additional display text omitted from this example]</p>                                     |
| Cisco 7200 series routers                                            | <b>show interfaces serial</b> , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                          | <p>The example is for interface 0 on a port adapter in port adapter slot 6.</p> <pre>Router# show interfaces serial 6/0</pre> <p>Serial 6/0 is administratively down,<br/>line protocol is down</p> <p>[Additional display text omitted from this example]</p>                                                                |
| Cisco 7301 routers                                                   | <b>show interfaces serial</b> , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                          | <p>The example is for interface 0 on a port adapter in port adapter slot 1.</p> <pre>Router# show interfaces serial 1/0</pre> <p>Serial 1/0 is administratively down,<br/>line protocol is down</p> <p>[Additional display text omitted from this example]</p>                                                                |
| Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router      | <b>show interfaces serial</b> , followed by <i>slot/port</i> (module-slot-number/interface-port-number)                                | <p>The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.</p> <pre>Router# show interfaces serial 3/0</pre> <p>Serial 3/0 is administratively down,<br/>line protocol is down</p> <p>[Additional display text omitted from this example]</p> |

Table 4-2 Examples of the `show interfaces serial` Command (continued)

| Platform                                              | Command                                                                                                                                                    | Example                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cisco 7401ASR router                                  | <b>show interfaces serial</b> , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)                                              | The example is for interface 0 on a port adapter in port adapter slot 1.<br><br>Router# <b>show interfaces serial 1/0</b><br><br>Serial 1/0 is administratively down,<br>line protocol is down<br><br>[Additional display text omitted from this example]                                            |
| VIP in Cisco 7000 series or Cisco 7500 series routers | <b>show interfaces serial</b> , followed by <i>slot/port adapter/port</i> (interface-processor-slot-number/port-adapter-slot-number/interface-port-number) | The example is for interface 0 on a port adapter in port adapter slot 1 of a VIP in interface processor slot 1.<br><br>Router# <b>show interfaces serial 1/1/0</b><br><br>Serial 1/1/0 is administratively down,<br>line protocol is down<br><br>[Additional display text omitted from this example] |

**Step 6** Reenable interfaces by doing the following:

- Repeat Step 3 to reenable an interface. Substitute the **no shutdown** command for the **shutdown** command.
- Repeat Step 4 to write the new configuration to memory. Use the **copy running-config startup-config** command.
- Repeat Step 5 to verify that the interfaces are in the correct state. Use the **show interfaces** command followed by the interface type and interface address of the interface.

For complete descriptions of software configuration commands, refer to the publications listed in the “[Related Documentation](#)” section on page viii.

## Performing a Basic Configuration

Following are instructions for a basic configuration: enabling an interface, specifying IP routing, and setting up external timing on a DCE interface. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration subcommands and the configuration options available for serial interfaces, refer to the appropriate software documentation.

In the following procedure, press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable
```

```
Router>
```

- Step 1** Enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:
- ```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```
- Step 2** Specify the first interface to configure by entering the **interface serial** subcommand, followed by the interface address of the interface you plan to configure. (The command for your port adapter may be different, for example, **interface atm**.) [Table 4-3](#) provides examples.

Table 4-3 Examples of the interface serial Subcommand

Platform	Command	Example
Catalyst 6000 family FlexWAN module in Catalyst 6000 family switches	interface serial , followed by <i>mod_num/bay/port</i> (module-slot-number/port-adapter-bay-number/interface-port-number)	The example is for interface 0 on a port adapter in bay 0 of a FlexWAN module installed in module slot 3. Router(config)# interface serial 3/0/0 Router(config-if)#
Cisco 7200 series routers	interface serial , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)	The example is for interface 0 of a port adapter in port adapter slot 6. Router(config)# interface serial 6/0 Router(config-if)#
Cisco 7301 routers	interface serial , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1. Router(config)# interface serial 1/0 Router(config-if)#
Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	interface serial , followed by <i>slot/port</i> (module-slot-number/interface-port-number)	The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router. Router(config)# interface serial 3/0 Router(config-if)#
Cisco 7401ASR router	interface serial , followed by <i>slot/port</i> (port-adapter-slot-number/interface-port-number)	The example is for interface 0 of a port adapter in port adapter slot 1. Router(config)# interface serial 1/0 Router(config-if)#
VIP in Cisco 7000 series or Cisco 7500 series routers	interface serial , followed by <i>slot/port adapter/port</i> (interface-processor-slot-number/port-adapter-slot-number/interface-port-number)	The example is for interface 0 of a port adapter in port adapter slot 1 of a VIP in interface processor slot 1. Router(config)# interface serial 1/1/0 Router(config-if)#

- Step 3** Assign an IP address and subnet mask to the interface (if IP routing is enabled on the system) by using the **ip address** subcommand, as in the following example:
- ```
Router(config-if)# ip address 10.0.0.0 10.255.255.255
```
- Step 4** Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.

- Step 5** Reenable the interfaces using the **no shutdown** command. (See the “[Shutting Down an Interface](#)” section on page 4-2.)
- Step 6** Configure all additional port adapter interfaces as required.
- Step 7** After including all of the configuration subcommands to complete your configuration, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.
- Step 8** Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

This completes the procedure for creating a basic configuration.

## Configuring Timing (Clock) Signals

All EIA/TIA-232 interfaces support both DTE and DCE mode, depending on the mode of the compact serial cable attached to the port. To use a port as a DTE interface, you need only connect a DTE compact serial cable to the port. When the system detects the DTE mode cable, it automatically uses the external timing signal. To use a port in DCE mode, you must connect a DCE compact serial cable and set the clock speed with the **clock rate** configuration command. You must also set the clock rate to perform a loopback test. This section describes how to set the clock rate on a DCE port and, if necessary, how to invert the clock to correct a phase shift between the data and clock signals. [Table 4-4](#) summarizes some of the commands used to configure the clock rate. See the specific sections that follow for further details.

**Table 4-4** Clock Rate Configuration Commands

| Purpose                                | Command              | Example                                                                                                                                                                                                                        | Additional Information                                 |
|----------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Set standard clock rate.               | <b>clock rate</b>    | The example is for a serial interface with a standard clock rate of 72 kbps.<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>clock rate 7200</b>                                                   | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Set nonstandard clock rate.            | <b>clock rate</b>    | The example is for a serial interface with a nonstandard clock rate of 1234567 kbps.<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>clock rate 1234567</b>                                        | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Remove a clock rate that has been set. | <b>no clock rate</b> | The example is for a serial interface and removes a standard clock rate of 72 kbps.<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>clock rate 7200</b><br>Router(config-if)# <b>no clock rate</b> | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Invert the transmit clock signal.      | <b>invert-txc</b>    | The example inverts the transmit clock signal for a serial interface.<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>invert-txc</b>                                                               | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |

Table 4-4 Clock Rate Configuration Commands (continued)

| Purpose                                             | Command              | Example                                                                                                                                                                                     | Additional Information                                 |
|-----------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Change the clock signal back to its original phase. | <b>no invert-txc</b> | The example sets the transmit clock signal for a serial interface back to its original phase.<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>no invert-txc</b> | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Invert the data signal.                             | <b>invert data</b>   | The example inverts the data stream for both transmit and receive for a serial interface:<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>invert data</b>       | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |

## Setting the Clock Rate

The default operation on a PA-T3+ DCE interface is for the DCE device to generate its own clock signal (TxC) and send it to the remote DTE. The remote DTE device returns the clock signal to the DCE (the PA-T3+). Set the clock rate of an interface using the **clock rate** subcommand, which specifies the clock rate as a bits-per-second value. This subcommand functions in the same way on all supported platforms.

Before you can assign a clock rate, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface to which you want to assign the clock rate value.

In the following example, the clock rate is specified as 72 kbps:

```
Router(config-if)# clock rate 72000
```

The preceding command example applies to all systems in which the PA-T3+ is supported. Use the **no clock rate** command to remove the clock rate.

Following are the standard clock rates:

1200, 2400, 4800, 9600, 19200 38400, 56000, 64000,  
72000, 125000 148000, 250000, 500000, 800000, 1000000,  
1300000, 2000000, 4000000, 8000000

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.



### Note

Cisco IOS Release 11.2(7a)P or a later release of 11.2 P, or Release 11.1(10)CA or a later release of 11.1 CA loaded on your Cisco 7200 router or on your Cisco 7000 series or Cisco 7500 series router with a VIP2-40(=) supports nonstandard clock rates (any value from 1200 to 8000000) on PA-T3+ interfaces.

Cisco IOS Release 12.0(3)T or a later release of 12.0 T, or Release 12.0(1)XE or a later release of 12.0 XE supports nonstandard clock rates on PA-T3+ interfaces installed in Cisco 7204VXR and Cisco 7206VXR routers.

Cisco IOS Release 11.3(7)NA or a later release of 11.3 NA, or Release 12.0(3)T or a later release of 12.0 T loaded on your Cisco uBR7200 series router supports nonstandard clock rates (any value from 1200 to 8000000) on PA-T3+ interfaces.

Nonstandard clock rates are rounded (if necessary) to the nearest clock rate that the hardware can support.

Set a nonstandard clock rate for an interface using the **clock rate** subcommand. Before you can assign a nonstandard clock rate, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface to which you want to assign the nonstandard clock rate value.

In the following example, a nonstandard clock rate of 1234567 bps is specified:

```
Router(config-if)# clock rate 1234567
```

The preceding command example applies to all systems in which the PA-T3+ is supported.

Use the **no clock rate** command to remove the clock rate.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

The following example shows how to use the **show running-config** command to determine the exact clock rate to which the nonstandard clock rate was rounded:

```
Router# show running-config
Building configuration...
...
!
interface Serial1/0 (interface Serial3/1/0 on a VIP2)

 no ip address
 clockrate 1151526
!
...
```

In the preceding example, only the relevant output from the **show running-config** command is shown; other information is omitted.

## Inverting the Clock Signal

Systems that use long cables or cables that are not transmitting the TxC (clock) signal might experience high error rates when operating at higher transmission speeds. If a PA-T3+ DCE port is reporting a high number of error packets, a phase shift might be the problem: inverting the clock might correct this phase shift.

When the EIA/TIA-232 interface is a DTE, the **invert-txc** command inverts the TxC signal the DTE receives from the remote DCE. When the EIA/TIA-232 interface is a DCE, the **invert-txc** command inverts the clock signal to the remote DTE port. Use the **no invert-txc** command to change the clock signal back to its original phase.

## Inverting the Data Signal

If you use an EIA/TIA-232 interface on the PA-T3+ port adapter to drive a dedicated T1 line that does not have B8ZS encoding—a method to avoid 15 zeros—you must invert the data stream (both TXD and RXD) either in the connecting CSU/DSU or on the interface. To invert the data stream coming out of the PA-T3+, use the **invert data** command. By inverting the HDLC data stream, the HDLC zero insertion algorithm becomes a ones insertion algorithm that satisfies the T1 requirements.

**Note**

Invert data *only* on the PA-T3+ interface *or* on the CSU/DSU; inverting both cancels out both data inversions.

## Configuring NRZI Format

Table 4-5 summarizes NRZI format commands. For more information, see the remainder of this section.

**Table 4-5 NRZI Format Commands**

| Purpose                | Command                                  | Example                                                                                                                                                                                                                                                                                                                                 | Further Information                                    |
|------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Enable NRZI encoding.  | <b>nrzi-encoding [mark]</b> <sup>1</sup> | <p>The example is for a serial interface with NRZI mark encoding specified:</p> <pre>Router(config)# interface serial 3/0 Router(config-if)# nrzi-encoding mark</pre> <p>The example is for a serial interface with NRZI space encoding specified:</p> <pre>Router(config)# interface serial 3/0 Router(config-if)# nrzi-encoding</pre> | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Disable NRZI encoding. | <b>no nrzi-encoding</b>                  | <p>The example disables NRZI encoding on a serial interface:</p> <pre>Router(config)# interface serial 3/0 Router(config-if)# no nrzi-encoding</pre>                                                                                                                                                                                    | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |

1. *Mark* is an optional argument. When *mark* is used, it means there is no signal transition; there is data (a mark) at the beginning of a bit interval. When *mark* is not used, it means there is a signal transition; there is no data (a space) at the beginning of a bit interval.

All EIA/TIA-232 interfaces on the PA-T3+ support nonreturn-to-zero (NRZ) and nonreturn-to-zero inverted (NRZI) formats. Both formats use two different voltage levels for transmission. NRZ signals maintain constant voltage levels with no signal transitions—no return to a zero voltage level—during a bit interval and are decoded using absolute values: 0 and 1. NRZI uses the same constant signal levels but interprets the absence of data—a space—at the beginning of a bit interval as a signal transition and the presence of data—a mark—as no signal transition. NRZI uses relational encoding to interpret signals rather than determining absolute values.

NRZ format—the factory default on all interfaces—is more common. NRZI format is commonly used with EIA/TIA-232 connections in IBM environments.

Enable NRZI encoding on any interface using the **nrzi-encoding [mark]** command, where no argument after the command is interpreted as a signal transition, and **mark** is interpreted as no signal transition. This command functions in the same way on all supported platforms. Before you can enable NRZI encoding, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface on which you want to enable NRZI encoding.

In the example that follows, NRZI encoding with a signal transition—no argument—is specified:

```
Router(config-if)# nrzi-encoding
```

In the example that follows, NRZI encoding with no signal transition—with argument—is specified:

```
Router(config-if)# nrzi-encoding mark
```

The preceding command examples apply to all systems in which the PA-T3+ is supported. Use the **no nrzi-encoding** command to disable NRZI encoding.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.

For complete command descriptions and instructions, refer to the *Configuration Fundamentals Configuration Guide* publication. For more information, see the [“Obtaining Documentation”](#) section on page x and the [“Obtaining Technical Assistance”](#) section on page xi.

## Configuring Cyclic Redundancy Checks

Table 4-6 summarizes cyclic redundancy check (CRC) commands. For more information, see the remainder of this section.

Table 4-6 CRC Commands

| Purpose                       | Command            | Example                                                                                                                                                                                | Further Information                                    |
|-------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Enable 32-bit CRC.            | <b>crc size</b>    | The example enables 32-bit CRD on a serial interface:<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>crc 32</b>                                           | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |
| Return to default 16-bit CRC. | <b>no crc size</b> | The example disables 32-bit CRD on a serial interface and returns to the default 16-bit CRC:<br><br>Router(config)# <b>interface serial 3/0</b><br>Router(config-if)# <b>no crc 32</b> | <a href="#">“Configuring Cyclic Redundancy Checks”</a> |

CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. All interfaces use a 16-bit CRC (CRC-CITT) by default but also support a 32-bit CRC. The sender of a data frame calculates the frame check sequence (FCS). Before it sends a frame, the sender appends the FCS value to the message. The receiver recalculates the FCS and compares its calculation to the FCS from the sender. If there is a difference between the two calculations, the receiver assumes that a transmission error occurred and sends a request to the sender to resend the frame.

Enable 32-bit CRC using the **crc 32** command. Before you can enable 32-bit CRC, you must use the **interface serial** command (followed by the interface address of the interface) to select the interface on which you want to enable 32-bit CRC. This command functions in the same way on all supported platforms.

In the example that follows, 32-bit CRC is specified:

```
Router(config-if)# crc 32
```

The preceding command example applies to all systems in which the PA-T3+ is supported. Use the **no crc 32** command to disable CRC-32 and return the interface to the default CRC-16 (CRC-CITT) setting.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt. Then write the new configuration to NVRAM using the **copy running-config startup-config** command.



For command descriptions, refer to the *Configuration Fundamentals Configuration Guide* publication. For more information, see the [“Obtaining Documentation”](#) section on page x and the [“Obtaining Technical Assistance”](#) section on page xi.

**Note**

If you are configuring a PA-T3+ in a Cisco 7200 router and you want to configure the interface for half-duplex or Bisync operation, proceed to the next section, [“Setting the Bandwidth”](#); otherwise, proceed to the [“Setting the Bandwidth”](#) section on page 4-15.

## Configuring Half-Duplex and Binary Synchronous Communications in Cisco 7200 Series Routers

This section explains how to configure EIA/TIA-232 interfaces for half-duplex and Bisync operation in Cisco 7200 routers.

**Note**

Cisco IOS Release 11.2(7a)P or a later release of 11.2 P supports half-duplex and Bisync operation on the PA-T3+ in Cisco 7200 routers.

Cisco IOS Release 11.1(19)CC1 or a later release of 11.1 CC, or Release 11.3(4)AA or a later release of 11.3 AA supports half-duplex and Bisync operation on the PA-T3+ installed in Cisco 7202 routers.

Cisco IOS Release 12.0(3)T or a later release of 12.0 T, or Release 12.0(2)XE or a later release of 12.0 XE supports half-duplex and Bisync operation on the PA-T3+ in Cisco 7204VXR and Cisco 7206VXR routers.

The Catalyst RSM/VIP2, Cisco 7100 series routers, Cisco uBR7200 series routers, and the VIP do *not* support half-duplex and Bisync operation on the PA-T3+.

Use the **half-duplex** command to configure EIA/TIA-232 interfaces for half-duplex mode; full-duplex mode is the default for low-speed serial interfaces. Serial DCE interfaces in half-duplex mode can be configured for controlled-carrier mode or constant-carrier mode; constant-carrier mode is the default. Controlled-carrier mode sets the EIA/TIA-232 interface to deactivate Data Carrier Detect (DCD) until a transmission is sent to the interface. After a transmission is received, DCD is activated and the interface waits a user-configured amount of time and then transmits the data. After the transmission, the interface waits a user-configured amount of time and then deactivates DCD. Constant-carrier mode activates DCD at all times.

Use the **half-duplex controlled-carrier** command to configure an EIA/TIA-232 interface for controlled-carrier mode. Use the **no half-duplex controlled-carrier** command to return the interface to constant-carrier mode.

Follow these steps to configure controlled-carrier mode on an EIA/TIA-232 interface:

- Step 1** Enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

- Step 2** Specify the interface to configure for controlled-carrier mode using the **interface serial** subcommand (followed by the interface address of the interface) and then enter the **half-duplex controlled-carrier** subcommand.

The following example is for the first interface of the port adapter in port adapter slot 1:

```
Router(config)# interface serial 1/0
Router(config-if)# half-duplex controlled-carrier
```

- Step 3** Specify the length of the timer delay the interface uses when it is configured for controlled-carrier mode by using the following command:

**half-duplex timer** {cts-delay *value* | cts-drop-timeout *value* | dcd-drop-delay *value* | dcd-txstart-delay *value* | rts-drop-delay *value* | rts-timeout *value* | transmit-delay *value*}

where *value* is the length of the timer delay in milliseconds.

The following example specifies a Data Carrier Detect (DCD) drop delay of 100 milliseconds on the first interface of a port adapter in port adapter slot 1:

```
Router(config)# interface serial 1/0
Router(config-if)# half-duplex timer dcd-drop-delay 100 ms
```

Table 4-7 lists the default delay settings and the *value* argument for each timer you can use with the **half-duplex timer** command.

**Table 4-7 Half-Duplex Timer Default Delay Settings**

| Timer                        | Command Syntax                             | Default Settings <sup>1</sup> |
|------------------------------|--------------------------------------------|-------------------------------|
| CTS delay <sup>2</sup>       | <b>half-duplex timer cts-delay</b>         | 0                             |
| CTS drop timeout             | <b>half-duplex timer cts-drop-timeout</b>  | 250                           |
| DCD drop delay <sup>3</sup>  | <b>half-duplex timer dcd-drop-delay</b>    | 100                           |
| DCD transmission start delay | <b>half-duplex timer dcd-txstart-delay</b> | 100                           |
| RTS drop delay <sup>4</sup>  | <b>half-duplex timer rts-drop-delay</b>    | 3                             |
| RTS timeout                  | <b>half-duplex timer rts-timeout</b>       | 3                             |
| Transmit delay               | <b>half-duplex transmit-delay</b>          | 0                             |

1. In milliseconds (ms).

2. Clear To Send (CTS).

3. Data Carrier Detect (DCD).

4. Request To Send (RTS).

- Step 4** Complete the configuration by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to exit configuration mode and return to the EXEC command interpreter prompt.

**Step 5** Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

---

This completes the procedure for configuring controlled-carrier mode on an EIA/TIA-232 interface. For additional information on configuring half-duplex operation on low-speed serial interfaces, refer to the chapter “Configuring Interfaces” of the *Configuration Fundamentals Configuration Guide* publication. For more information, see the [“Obtaining Documentation” section on page x](#) and the [“Obtaining Technical Assistance” section on page xi](#).



**Note**

To configure EIA/TIA-232 interfaces for Binary Synchronous (Bisync) operation in Cisco 7200 routers, refer to the “Block Serial Tunneling (BSTUN)” section of the “Configuring Serial Tunnel (STUN) and Block Serial Tunnel (BSTUN)” chapter of the *Bridging and IBM Networking Configuration Guide*.

---

## Setting the Bandwidth

In interface configuration mode, reduce effective bandwidth (range of 22 to 44210 kbps) by entering the **dsu bandwidth** configuration subcommand, as in the following example:

```
router(config-if)# dsu bandwidth 16000
```

Use the **no** form of this command to return to the default, 44210.



**Note**

The local port configuration must match the remote port configuration. For example, if you reduce the effective bandwidth to 16000 on the local port, you must do the same on the remote port.

---

## Defining the DSU Mode

In interface configuration mode, define the DSU interoperability mode by entering the **dsu mode [0 | 1 | 2]** configuration subcommand, as in the following example:

```
router(config-if)# dsu mode 1
```

Use the **no** form of this command to return to the default, 0.



**Note**

The local port configuration must match the remote port configuration. For example, if you define the DSU interoperability mode as 1 on the local port, you must do the same on the remote port. You need to know what type of DSU is at the remote port to find out if it interoperates with the PA-T3+. For T3+ serial interfaces, specify mode 0 for connection from a PA-T3+ to another PA-T3+ or a Digital Link DSU (DL3100). Specify mode 1 for connection from a PA-T3+ to a Kentrox DSU. Specify mode 2 for connection from a PA-T3+ to a Larscom DSU.

---

Also see the [“Interoperability Guidelines for PA-T3+ DSUs” section on page 1-3](#) for information regarding DSU feature compatibilities.

## Enabling T3+ Scrambling

In interface configuration mode, enable T3+ scrambling by entering the **scramble** configuration subcommand, as in the following example:

```
router(config-if)# scramble
```

Use the **no** form of this command to restore the default value, disabled.

**Note**

The local port configuration must match the remote port configuration. For example, if you enable scrambling on the local port, you must do the same on the remote port.

Also see the [“Interoperability Guidelines for PA-T3+ DSUs”](#) section on page 1-3 for information regarding DSU feature compatibilities.

## Specifying T3+ Framing

In interface configuration mode, specify T3+ framing by entering the **framing {c-bit | m13 | bypass}** configuration subcommand, as in the following example:

```
router(config-if)# framing c-bit
```

Use the **no** form of this command to return to the default, C-bit framing.

**Note**

If you use the **bypass** option, scrambling must be set to the default, disabled; the DSU mode must be set to the default, 0; and the DSU bandwidth must be set to the default, 44210.

## Setting the Cable Length

In interface configuration mode, set the cable length (0 to 450 feet), as in the following example:

```
router(config-if)# cablelength 250
```

Use the **no** form of this command to return to the default, which is 10 feet.

## Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces, and use the **ping** and **loopback** commands to check connectivity. This section includes the following subsections:

- [Using show Commands to Verify the New Interface Status, page 4-17](#)
- [Using the ping Command to Verify Network Connectivity, page 4-24](#)
- [Using loopback Commands, page 4-25](#)

## Using show Commands to Verify the New Interface Status

Table 4-8 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-T3+ appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the “[Related Documentation](#)” section on page viii.



### Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

**Table 4-8** Using show Commands

| Command                                                                                                     | Function                                                                                                                                                                   | Example                                     |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>show version</b> or<br><b>show hardware</b>                                                              | Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images | Router# <b>show version</b>                 |
| <b>show controllers</b>                                                                                     | Displays all the current interface processors and their interfaces                                                                                                         | Router# <b>show controllers</b>             |
| <b>show diag slot</b>                                                                                       | Displays types of port adapters installed in your system and information about a specific port adapter slot, interface processor slot, or chassis slot                     | Router# <b>show diag 2</b>                  |
| <b>show interfaces type module-slot- number/ port-adapter-bay-number/ interface-port-number</b>             | Displays status information about a specific type of interface (for example, serial) on a Catalyst 6000 family FlexWAN module                                              | Router# <b>show interfaces serial 3/0/0</b> |
| <b>show interfaces type port-adapter-slot-number/ interface-port-number</b>                                 | Displays status information about a specific type of interface (for example, serial) in a Cisco 7200 series and Cisco 7301 router.                                         | Router# <b>show interfaces serial 1/0</b>   |
| <b>show interfaces type 2 or 3 or 4 or 5/ interface-port-number</b>                                         | Displays status information about a specific type of interface (for example, serial) on a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router                  | Router# <b>show interfaces serial 3/0</b>   |
| <b>show interfaces type interface-processor-slot-number/port-adapter-slot-number/ interface-port-number</b> | Displays status information about a specific type of interface (for example, serial) on a VIP in a Cisco 7000 series or Cisco 7500 series router                           | Router# <b>show interfaces serial 3/1/0</b> |

Table 4-8 Using show Commands (continued)

| Command                    | Function                                                                        | Example                            |
|----------------------------|---------------------------------------------------------------------------------|------------------------------------|
| <b>show protocols</b>      | Displays protocols configured for the entire system and for specific interfaces | Router# <b>show protocols</b>      |
| <b>show running-config</b> | Displays the running configuration file                                         | Router# <b>show running-config</b> |
| <b>show startup-config</b> | Displays the configuration stored in NVRAM                                      | Router# <b>show startup-config</b> |

If an interface is shut down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections and offers platform-specific output examples for some of the supported platforms:

- [Using the show version or show hardware Commands, page 4-18](#)
- [Using the show diag Command, page 4-21](#)
- [Using the show interfaces Command, page 4-23](#)

Choose the subsection appropriate for your system. Proceed to the [“Using the ping Command to Verify Network Connectivity” section on page 4-24](#) when you have finished using the **show** commands.

## Using the show version or show hardware Commands

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images, using the **show version** (or **show hardware**) command.



### Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only and not all platforms are represented.

## Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches

Following is an example of the **show version** command from a Catalyst 6000 family switch with the PA-T3+:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) MSFC Software (C6MSFC-JSV-M), Experimental Version 12.1(20000209:134547)
[amcrae-cosmos_e_nightly 163]
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Wed 09-Feb-00 07:10 by
Image text-base: 0x60008900, data-base: 0x6140E000

ROM: System Bootstrap, Version 12.0(3)XE, RELEASE SOFTWARE

const-uut uptime is 5 minutes
System returned to ROM by reload
System image file is "bootflash:c6msfc-jsv-mz.Feb9"

cisco Cat6k-MSFC (R5000) processor with 122880K/8192K bytes of memory.
```

```

Processor board ID SAD03457061
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
Last reset from power-on
Channelized E1, Version 1.0.
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
6 FlexWAN controllers (13 Serial)(8 E1)(8 T1)(2 HSSI)(2 ATM)(1 Channelized T3)(1
Channelized E3)(2 POS).
1 Virtual Ethernet/IEEE 802.3 interface(s)
17 Serial network interface(s)
2 HSSI network interface(s)
2 ATM network interface(s)
2 Packet over SONET network interface(s)
1 Channelized T3 port(s)
1 Channelized E3 port(s)
123K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

16384K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x1

```

## Cisco 7200 Series Routers

Following is an example of the **show version** command from a Cisco 7200 series router with the PA-T3+:

```

Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 16:44 by
Image text-base:0x600088E0, data-base:0x60882000

ROM: System Bootstrap, Version 11.1(13)CA, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 48 minutes
System restarted by reload
System image file is "slot0:c7200-j-mz.111CC", booted via console

cisco 7206 (NPE200) processor with 122880K/8192K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
3 FastEthernet/IEEE 802.3 interfaces.
3 Serial network interfaces.
125K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0

```

## Cisco 7401ASR Routers

Following is an example of the **show version** command from a Cisco 7401ASR router with the PA-T3+:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7401ASR Software (C7401ASR-J-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 16:44 by
Image text-base:0x600088E0, data-base:0x60882000

ROM:System Bootstrap, Version 11.1(13)CA, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 48 minutes
System restarted by reload
System image file is "slot0:c7200-j-mz.111CC", booted via console

cisco 7401ASR processor with 122880K/8192K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
3 FastEthernet/IEEE 802.3 interfaces.
3 Serial network interfaces.
125K bytes of non-volatile configuration memory.
4096K bytes of packet SRAM memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
```

## VIP in Cisco 7000 Series and Cisco 7500 Series Routers

Following is an example of the **show version** command from a Cisco 7500 series router with the PA-T3+:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-PV-M), Released Version 11.1(24)CC
FIB_branch Synced to mainline version:11.1(21.2)CA
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 03-Nov-98 17:20 by
Image text-base:0x60010910, data-base:0x6081E000

ROM:System Bootstrap, Version 11.1(8)CA1, RELEASE SOFTWARE

router uptime is 2 days, 14 hours, 52 minutes
System restarted by reload
System image file is "rsp-pv-mz.111CC", booted via console

cisco RSP4 (R5000) processor with 65536K/2072K bytes of memory.
R5000 processor, Implementation 35, Revision 2.1 (512KB Level 2 Cache)
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 software, Version 1.0.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.
1 EIP controller (6 Ethernet).
1 VIP2 controller (4 Serial).
```



```

2 VIP2 R5K controllers (2 Serial)(2 HSSI).
6 Ethernet/IEEE 802.3 interfaces.
6 Serial network interfaces.
2 HSSI network interfaces.
123K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x100

```

## Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag slot** command, where *slot* is the *port adapter slot* in a Cisco 7200 series or Cisco 7401ASR router, and the *interface processor slot* in a Cisco 7000 series or Cisco 7500 series router with a VIP. The following examples show output for some of the supported platforms.



### Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

## Catalyst 6000 FlexWAN Module in Catalyst 6000 Family Switches

Following is an example of the **show diag** command that shows a PA-T3+ in chassis slot 9 on a Catalyst 6000 family FlexWAN module:

```

router# show diag

[Additional display text omitted from this example]
Slot 9: Logical_index 18
 Board is analyzed ipc ready FlexWAN controller

 Slot database information:
 Flags: 0x2004Insertion time: unknown

 CWAN Controller Memory Size: Unknown

PA Bay 0 Information:
 T3+ Serial PA, 1 ports
 EEPROM format version 0
 HW rev 0.00, Board revision UNKNOWN
 Serial number: 00000000 Part number: 00-0000-00
[Additional display text omitted from this example]

```

## Cisco 7200 Series Routers

Following is an example of the **show diag slot** command that shows PA-T3+ in port adapter slot 6 of a Cisco 7200 series router:

```

Router# show diag 6

Slot 6:
 T3+ PA port adapter, 1 port
 Port adapter is analyzed
 Port adapter insertion time 2d14h ago
 Hardware revision 255.255 Board revision UNKNOWN
 Serial number 4294967295 Part number 255-65535-255
 Test history 0xFF RMA number 255-255-255
 EEPROM format version 1

```

```
EEPROM contents (hex):
0x20:01 CB FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x30:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

## Cisco 7401ASR Routers

Following is an example of the **show diag slot** command that shows PA-T3+ in port adapter slot 1 of a Cisco 7401ASR router:

```
Router# show diag 1

Slot 1:
T3+ PA port adapter, 1 port
Port adapter is analyzed
Port adapter insertion time 2d14h ago
Hardware revision 255.255 Board revision UNKNOWN
Serial number 4294967295 Part number 255-65535-255
Test history 0xFF RMA number 255-255-255
EEPROM format version 1
EEPROM contents (hex):
0x20:01 CB FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x30:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

## VIP in Cisco 7000 Series and Cisco 7500 Series Routers

Following is an example of the **show diag slot** command that shows a PA-T3+ in port adapter slot 1 on a VIP in interface processor slot 1:

```
Router# show diag 10
slot 10:
Physical slot 1, ~physical slot 0xE, logical slot 1, CBus 0
Microcode Status 0x4
Master Enable, LED, WCS Loaded
Board is analyzed
Pending I/O Status:None
EEPROM format version 1
VIP2 R5K controller, HW rev 2.02, board revision A0
Serial number:08217772 Part number:73-2167-04
Test history:0x00 RMA number:00-00-00
Flags:cisco 7000 board; 7500 compatible

EEPROM contents (hex):
0x20:01 1E 02 02 00 7D 64 AC 49 08 77 04 00 00 00 00
0x30:50 00 00 01 00 00 00 00 00 00 00 00 00 00 00
Slot database information:
Flags:0x4 Insertion time:0x1B28 (2d14h ago)

Controller Memory Size:64 MBytes DRAM, 8192 KBytes SRAM

PA Bay 0 Information:
T3+ Serial PA, 1 ports
EEPROM format version 1
HW rev 255.255, Board revision UNKNOWN
Serial number:4294967295 Part number:255-65535-255

PA Bay 1 Information:
T3+ Serial PA, 1 ports
EEPROM format version 1
HW rev 255.255, Board revision UNKNOWN
Serial number:4294967295 Part number:255-65535-255
```

## Using the show interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify. The following examples show output for some of the supported platforms; all of the examples specify serial interfaces.

For complete descriptions of interface subcommands and the configuration options available for Cisco 7200 series or Cisco 7401ASR router, and VIP interfaces, refer to the publications listed in the [“Related Documentation” section on page viii](#).



### Note

The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

### Catalyst 6000 Family FlexWAN Module in Catalyst 6000 Family Switches

Following is an example of the **show interfaces** command used with the FlexWAN module. In this example, the two serial interfaces (0 to 1) are on a port adapter in bay 0 of a FlexWAN module in module slot 9; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
router# show interfaces serial 9/0/0
Serial9/0/0 is administratively down, line protocol is down
 Hardware is PODS3+ Serial
 MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
 reliability 255/255, txload 1/255, rxload 1/255
 Encapsulation HDLC, crc 16, loopback not set
[Additional display text omitted from this example]

router# show interfaces serial 9/0/1
Serial9/0/1 is administratively down, line protocol is down
 Hardware is PODS3+ Serial
 MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
 reliability 255/255, txload 1/255, rxload 1/255
 Encapsulation HDLC, crc 16, loopback not set
[Additional display text omitted from this example]
```

### Cisco 7200 Series Routers

Following is an example of the **show interfaces** command for Cisco 7200 series routers. In this example, the serial two interfaces (0 to 1) are on a port adapter in port adapter slot 1; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 1/0
Serial1/0 is up, line protocol is up
 Hardware is M8T-RS232
 Internet address is 10.0.0.0
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]

Router# show interfaces serial 1/1
Serial1/1 is up, line protocol is up
 Hardware is M8T-RS232
 Internet address is 10.0.0.1
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]
```

## Cisco 7401ASR Routers

Following is an example of the **show interfaces** command for Cisco 7401ASR routers. In this example, the serial two interfaces (0 to 1) are on a port adapter in port adapter slot 1; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 1/0
Serial1/0 is up, line protocol is up
 Hardware is M8T-RS232
 Internet address is 10.0.0.0
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]

Router# show interfaces serial 1/1
Serial1/1 is up, line protocol is up
 Hardware is M8T-RS232
 Internet address is 10.0.0.1
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive set (10 sec)
[Additional display text omitted from this example]
```

## VIP in Cisco 7000 Series or Cisco 7500 Series Routers

Following is an example of the **show interfaces** command used with the VIP. In this example, the two serial interfaces (0 to 1) are on a port adapter in port adapter slot 1 of a VIP in interface processor slot 3; also, most of the status information for each interface is omitted. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces serial 3/1/0
Serial3/1/0 is up, line protocol is up
 Hardware is cyBus Serial
 Internet address is 10.0.0.0
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive not set
[Additional display text omitted from this example]

Router# show interfaces serial 3/1/1
Serial3/1/1 is up, line protocol is up
 Hardware is cyBus Serial
 Internet address is 10.0.0.1
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set, keepalive not set
[Additional display text omitted from this example]
```

Proceed to the next section, [“Using the ping Command to Verify Network Connectivity,”](#) to check network connectivity of the *PA-T3+* and switch or router.

## Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. This section provides a brief description of this command. Refer to the publications listed in the [“Related Documentation”](#) section on page viii for detailed command descriptions and examples.

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not

returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), and repeat the **ping** command.

Proceed to the next section, “[Using loopback Commands](#),” to finish checking network connectivity.

## Using loopback Commands

With the loopback test, you can detect and isolate equipment malfunctions by testing the connection between the PA-T3+ interface and a remote device such as a modem or a CSU/DSU. The **loopback** command places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device or compact serial cable. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or compact serial cable in the path of the loopback test.

Depending on the mode of the port, issuing the **loopback** command checks the following path:

- When no compact serial cable is attached to the PA-T3+ interface port, or if a DCE cable is attached to a port that is configured as line protocol up, the **loopback** command tests the path between the network processing engine and the interface port only (without leaving the network processing engine and port adapter).
- When a DTE cable is attached to the port, the **loopback** command tests the path between the network processing engine and the near (network processing engine) side of the DSU or modem to test the PA-T3+ interface and compact serial cable.

[Table 4-9](#) provides examples of the **loopback {dte | local | network {line | payload} | remote}** command. The examples given are for interface 0 of a one-port PA-T3+ in port adapter slot 0 of a VIP in chassis slot 10 of a Cisco 7500 series router:

**Table 4-9 Using loopback Commands**

| Command               | Function                                                                                                                                          | Example                                                                                    |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>loopback dte</b>   | Sets the interface into loopback data terminal equipment (DTE). Loopback DTE loops the router output data back toward the router (after the LIU). | Router(config)# <b>interface serial 1/0</b><br>router(config-if)# <b>loopback dte</b>      |
| <b>loopback local</b> | Sets the interface into local loopback mode. Local loopback loops the router output data back toward the router at the framer.                    | Router(config)# <b>interface serial 10/0/0</b><br>router(config-if)# <b>loopback local</b> |

**Table 4-9** Using loopback Commands

| Command                            | Function                                                                                                                                               | Example                                                                                              |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>loopback network line</b>       | Sets the interface into network line loopback mode. Network line loopback loops the data back toward the network (before the framer).                  | Router(config)# <b>interface serial 10/0/0</b><br>router(config-if)# <b>loopback network line</b>    |
| <b>loopback network payload</b>    | Sets the interface into network payload loopback mode. Network payload loopback loops just the payload data back toward the network at the T3+ framer. | Router(config)# <b>interface serial 10/0/0</b><br>router(config-if)# <b>loopback network payload</b> |
| <b>loopback remote<sup>1</sup></b> | Sets the interface into remote loopback mode. Remote loopback loops the data back toward the network (before the framer at the remote T3 device).      | Router(config)# <b>interface serial 10/0/0</b><br>router(config-if)# <b>loopback remote</b>          |

1. Remote loopback mode works with C-bit framing only. The other loopback modes listed above work with C-bit, M13, and bypass framing. Refer to the [“Specifying T3+ Framing” section on page 4-16](#) for information on configuring C-bit framing.